

Characterization And Modeling Of Digital Circuits

A book is like a window that allows you to look into the world. The window is shaped by the author and that makes that every window presents a unique view of the world. This is certainly true for this book. It is shaped by the topics and the projects throughout my career. Even more so, this book reflects my own style of working and thinking. That starts already in Chap. 2. When I joined Philips Research in 1979, many of my colleagues used little paper notebooks to keep track of the most used equations and other practical things. This notebook was the beginning for Chap. 2: a collection of topics that form the basis for much of the other chapters. Chapter 2 is not intended to explain these topics, but to refresh your knowledge and help you when you need some basics to solve more complex issues. In the chapters discussing the fundamental processes of conversion, you will recognize my preoccupation with mathematics. I really enjoy finding an equation that properly describes the underlying mechanism. Nevertheless mathematics is not a goal in itself: the equations help to understand the way the variables are connected to the result. Real insight comes from understanding the physics and electronics. In the chapters on circuit design I have tried to reduce the circuit diagrams to the simplest form, but not simpler. . . I do have private opinions on what works and what should not be applied.

This text emphasizes the intricate relationship between adaptive filtering and signal analysis - highlighting stochastic processes, signal representations and properties, analytical tools, and implementation methods. This second edition includes new chapters on adaptive techniques in communications and rotation-based algorithms. It provides practical applications in information, estimation, and circuit theories.

A comprehensive reference giving a thorough explanation of propagation mechanisms, channel characteristics results, measurement approaches and the modelling of channels Thoroughly covering channel characteristics and parameters, this book provides the knowledge needed to design various wireless systems, such as cellular communication systems, RFID and ad hoc wireless communication systems. It gives a detailed introduction to aspects of channels before presenting the novel estimation and modelling techniques which can be used to achieve accurate models. To systematically guide readers through the topic, the book is organized in three distinct parts. The first part covers the fundamentals of the characterization of propagation channels, including the conventional single-input single-output (SISO) propagation channel characterization as well as its extension to multiple-input multiple-output (MIMO) cases. Part two focuses on channel measurements and channel data post-processing. Wideband channel measurements are introduced, including the equipment, technology and advantages and disadvantages of different data acquisition schemes. The channel parameter estimation methods are then presented, which include conventional spectral-based estimation, the specular-path-model based high-resolution method, and the newly derived power spectrum estimation methods. Measurement results are used to compare the performance of the different estimation methods. The third part gives a complete introduction to different modelling approaches. Among them, both scattering theoretical channel modelling and measurement-based channel modelling approaches are detailed. This part also approaches how to utilize these two modelling approaches to investigate wireless channels for conventional cellular systems and some new emerging communication systems. This three-part approach means the book caters for the requirements of the audiences at different levels, including readers needing introductory knowledge, engineers who are looking for more advanced understanding, and expert researchers in wireless system design as a reference. Presents technical explanations, illustrated with examples of the theory in practice Discusses results applied to 4G communication systems and other emerging communication systems, such as relay, CoMP, and vehicle-to-vehicle rapid time-variant channels Can be used as comprehensive tutorial for students or a complete reference for engineers in industry Includes selected illustrations in color Program downloads available for readers Companion website with program downloads for readers and presentation slides and solution manual for instructors Essential reading for Graduate students and researchers interested in the characteristics of propagation channel, or who work in areas related to physical layer architectures, air interfaces, navigation, and wireless sensing

This is the first of two volumes that together provide an overview of the latest advances in the generation and application of digital twins in bioprocess design and optimization. Both processes have undergone significant changes over the past few decades, moving from data-driven approaches into the 21st-century digitalization of the bioprocess industry. Moreover, the high demand for biotechnological products calls for efficient methods during research and development, as well as during tech transfer and routine manufacturing. In this regard, one promising tool is the use of digital twins, which offer a virtual representation of the bioprocess. They reflect the mechanistic of the biological system and the interactions between process parameters, key performance indicators and product quality attributes in the form of a mathematical process model. Furthermore, digital twins allow us to use computer-aided methods to gain an improved process understanding, to test and plan novel bioprocesses, and to efficiently monitor them. This book explains the mathematical structure of digital twins, their development and the model's respective parts, as well as concepts for the knowledge-driven generation and structural variability of digital twins. Covering fundamentals as well as applications, the two volumes offer the ideal introduction to the topic for researchers in academy and industry alike.

This book provides a comprehensive overview of characterization techniques and advanced modeling of VLSI circuits for modern and advanced process nodes for timing, power, noise and variation models. Intended audience includes research professionals, graduate students, circuit and PDK designers, characterization engineers, CAD developers, managers, mentors, and the merely curious. It is organized to serve as a compendium to a beginner, a ready reference to intermediate and source for an expert.

This is the definitive guide to X-parameters, written by the original inventors and developers of this powerful new paradigm for nonlinear RF and microwave components and systems. Learn how to use X-parameters to overcome intricate problems in nonlinear RF and microwave engineering. The general theory behind X-parameters is carefully and intuitively introduced, and then simplified down to specific, practical cases, providing you with useful approximations that will greatly reduce the complexity of measuring, modeling and designing for nonlinear regimes of operation. Containing real-world case studies, definitions of standard symbols and notation, detailed derivations within the appendices, and exercises with solutions, this is the definitive stand-alone reference for researchers, engineers, scientists and students looking to remain on the cutting-edge of RF and microwave engineering.

This publication is the first book on the development and application of digital terrain modeling for regional planning and policy support. It is a compilation of research results by international

research groups at the European Commission's Joint Research Centre, providing scientific support to the development and implementation of EU environmental policy. This practice-oriented book is recommended reading for practising environmental modelers and GIS experts working on regional planning and policy support applications.

This book is a result of a career spent developing and applying computer techniques for the geosciences. The need for a geoscience modeling reference became apparent during participation in several workshops and conferences on the subject in the last three years. For organizing these, and for the lively discussions that ensued and inevitably contributed to the contents, I thank Keith Turner, Brian Kelk, George Pflug and Johnathan Raper. The total number of colleagues who contributed in various ways over the preceding years to the concepts and techniques presented is beyond count. The book is dedicated to all of them. Compilation of the book would have been impossible without assistance from a number of colleagues who contributed directly. In particular, Ed Rychkun, Joe Ringwald, Dave Elliott, Tom Fisher and Richard Saccany reviewed parts of the text and contributed valuable comment. Mohan Srivastava reviewed and contributed to some of the geostatistical presentations. Mark Stoakes, Peter Dettlaff and Simon Wigzell assisted with computer processing of the many application examples. Anar Khanji and Randal Crombe assisted in preparation of the text and computer images. Klaus Lamers assisted with printing. The US Geological Survey, the British Columbia Ministry of Environment, Dave Elliott and others provided data for the application examples. My sincere thanks to all of them.

This work takes advantage of high-resolution silicon stencil masks to build air-stable complementary OTFTs using a low-temperature fabrication process. Plastic electronics based on organic thin-film transistors (OTFTs) pave the way for cheap, flexible and large-area products. Over the past few years, OTFTs have undergone remarkable advances in terms of reliability, performance and scale of integration. Many factors contribute to the allure of this technology; the masks exhibit excellent stiffness and stability, thus allowing OTFTs with submicrometer channel lengths and superb device uniformity to be patterned. Furthermore, the OTFTs employ an ultra-thin gate dielectric that provides a sufficiently high capacitance to enable the transistors to operate at voltages as low as 3 V. The critical challenges in this development are the subtle mechanisms that govern the properties of aggressively scaled OTFTs. These mechanisms, dictated by device physics, are well described and implemented into circuit-design tools to ensure adequate simulation accuracy.

Rather than only being a complication to dark current correction, the presence of such pixels, and the model explaining their behavior, presents an opportunity to obtain information, such as the depth of these recombination-generation sites, which will aid in refining manufacturing processes for digital imagers.

In the high frequency world, the passive technologies required to realize RF and microwave functionality present distinctive challenges. SAW filters, dielectric resonators, MEMS, and waveguide do not have counterparts in the low frequency or digital environment. Even when conventional lumped components can be used in high frequency applications, their behavior does not resemble that observed at lower frequencies. RF and Microwave Passive and Active Technologies provides detailed information about a wide range of component technologies used in modern RF and microwave systems. Updated chapters include new material on such technologies as MEMS, device packaging, surface acoustic wave (SAW) filters, bipolar junction and heterojunction transistors, and high mobility electron transistors (HMETs).

The book also features a completely rewritten section on wide bandgap transistors.

Practical Reservoir Characterization expertly explains key technologies, concepts, methods, and terminology in a way that allows readers in varying roles to appreciate the resulting interpretations and contribute to building reservoir characterization models that improve resource definition and recovery even in the most complex depositional environments. It is the perfect reference for senior reservoir engineers who want to increase their awareness of the latest in best practices, but is also ideal for team members who need to better understand their role in the characterization process. The text focuses on only the most critical areas, including modeling the reservoir unit, predicting well behavior, understanding past reservoir performance, and forecasting future reservoir performance. The text begins with an overview of the methods required for analyzing, characterizing, and developing real reservoirs, then explains the different methodologies and the types and sources of data required to characterize, forecast, and simulate a reservoir. Thoroughly explains the data gathering methods required to characterize, forecast, and simulate a reservoir Provides the fundamental background required to analyze, characterize, and develop real reservoirs in the most complex depositional environments Presents a step-by-step approach for building a one, two, or three-dimensional representation of all reservoir types

Earth science is becoming increasingly quantitative in the digital age. Quantification of geoscience and engineering problems underpins many of the applications of big data and artificial intelligence. This book presents quantitative geosciences in three parts. Part 1 presents data analytics using probability, statistical and machine-learning methods. Part 2 covers reservoir characterization using several geoscience disciplines: including geology, geophysics, petrophysics and geostatistics. Part 3 treats reservoir modeling, resource evaluation and uncertainty analysis using integrated geoscience, engineering and geostatistical methods. As the petroleum industry is heading towards operating oil fields digitally, a multidisciplinary skillset is a must for geoscientists who need to use data analytics to resolve inconsistencies in various sources of data, model reservoir properties, evaluate uncertainties, and quantify risk for decision making. This book intends to serve as a bridge for advancing the multidisciplinary integration for digital fields. The goal is to move beyond using quantitative methods individually to an integrated descriptive-quantitative analysis. In big data, everything tells us something, but nothing tells us everything.

This book emphasizes the integrated, multidisciplinary solutions for practical problems in resource evaluation and field development.

This book constitutes the refereed proceedings of the Third International Conference on Digital Human Modeling, ICDHM 2011, held in Orlando, FL, USA in July 2011. The 58 revised papers presented were carefully reviewed and selected from numerous submissions. The papers accepted for presentation thoroughly cover the thematic area of anthropometry applications, posture and motion modeling, digital human modeling and design, cognitive modeling, and driver modeling.

The hydraulic properties of the Ozark aquifer and its upper confining unit were measured as part of the site characterization for the City Utilities Shallow Carbon Sequestration Demonstration Project. The goal was to delineate the cone of depression/capture zone (of any upward leaking CO₂) produced by three onsite production wells above the CO₂ injection zone and to model future changes in this cone due to increased pumpage in nearby municipal wells. A three month cessation of pumping in two of the three production wells allowed a unique opportunity to measure the aquifer response to the decreased pumping. Aquifer tests yielded limiting transmissivity values of 0.017 to 0.053 ft²/sec. with a median value of 0.029 ft²/sec. and a storativity value centered around 3 x 10⁻⁴. Digital model simulations of the steady potentiometric surface closely match measured levels with a calibrated transmissivity of 0.030 ft²/sec and a vertical hydraulic conductivity within the confining unit of 3 x 10⁻¹¹ ft/sec. Thus, these calibrated values are very consistent with measured values and the calibrated model should provide reasonable estimates of the future capture zone under various pumping scenarios.

This textbook is appropriate for use in graduate-level curricula in analog-to-digital conversion, as well as for practicing engineers in need of a state-of-the-art reference on data converters. It discusses various analog-to-digital conversion principles, including sampling, quantization, reference generation, nyquist architectures and sigma-delta modulation. This book presents an overview of the state of the art in this field and focuses on issues of optimizing accuracy and speed, while reducing the power level. This new, third edition emphasizes novel calibration concepts, the specific requirements of new systems, the

consequences of 22-nm technology and the need for a more statistical approach to accuracy. Pedagogical enhancements to this edition include additional, new exercises, solved examples to introduce all key, new concepts and warnings, remarks and hints, from a practitioner's perspective, wherever appropriate. Considerable background information and practical tips, from designing a PCB, to lay-out aspects, to trade-offs on system level, complement the discussion of basic principles, making this book a valuable reference for the experienced engineer.

A practical methodology for designing integrated automation control for systems and processes Implementing digital control within mechanical-electronic (mechatronic) systems is essential to respond to the growing demand for high-efficiency machines and processes. In practice, the most efficient digital control often integrates time-driven and event-driven characteristics within a single control scheme. However, most of the current engineering literature on the design of digital control systems presents discrete-time systems and discrete-event systems separately. Control Of Mechatronic Systems: Model-Driven Design And Implementation Guidelines unites the two systems, revisiting the concept of automated control by presenting a unique practical methodology for whole-system integration. With its innovative hybrid approach to the modeling, analysis, and design of control systems, this text provides material for mechatronic engineering and process automation courses, as well as for self-study across engineering disciplines. Real-life design problems and automation case studies help readers transfer theory to practice, whether they are building single machines or large-scale industrial systems. Presents a novel approach to the integration of discrete-time and discrete-event systems within mechatronic systems and industrial processes Offers user-friendly self-study units, with worked examples and numerous real-world exercises in each chapter Covers a range of engineering disciplines and applies to small- and large-scale systems, for broad appeal in research and practice Provides a firm theoretical foundation allowing readers to comprehend the underlying technologies of mechatronic systems and processes Control Of Mechatronic Systems is an important text for advanced students and professionals of all levels engaged in a broad range of engineering disciplines.

This book provides comprehensive overview of characterization techniques and advanced modeling of VLSI circuits for modern and advanced process nodes up to 10nm. Intended audience includes research professionals, graduate students, circuit and PDK designers, characterization engineers, CAD developers, managers, mentors, and the merely curious. It is organized to serve as a compendium to a beginner, a ready reference to intermediate and source for an expert on the topics mentioned within.

A comprehensive, one-stop synthesis of landslide science, for researchers and graduate students in geomorphology, engineering geology and geophysics.

CMOS technology has now reached a state of evolution, in terms of both frequency and noise, where it is becoming a serious contender for radio frequency (RF) applications in the GHz range. Cutoff frequencies of about 50 GHz have been reported for 0.18 μm CMOS technology, and are expected to reach about 100 GHz when the feature size shrinks to 100 nm within a few years. This translates into CMOS circuit operating frequencies well into the GHz range, which covers the frequency range of many of today's popular wireless products, such as cell phones, GPS (Global Positioning System) and Bluetooth. Of course, the great interest in RF CMOS comes from the obvious advantages of CMOS technology in terms of production cost, high-level integration, and the ability to combine digital, analog and RF circuits on the same chip. This book discusses many of the challenges facing the CMOS RF circuit designer in terms of device modeling and characterization, which are crucial issues in circuit simulation and design.

This book focuses on a specific engineering problem that is and will continue to be important in the forth-coming information age: namely, the need for highly integrated radio systems that can be embedded in wireless devices for various applications, including portable mobile multimedia wireless communications, wireless appliances, digital cellular, and digital cordless. Traditionally, the design of radio IC's involves a team of engineers trained in a wide range of fields that include networking, communication systems, radio propagation, digital/analog circuits, RF circuits, and process technology. However as radio IC's become more integrated, the need for a diverse skill set and knowledge becomes essential for professionals as well as students to broaden beyond their trained area of expertise and to become proficient in related areas. The key to designing an optimized, economical solution for radio systems on a chip hinges on the designer's thorough understanding of the complex trade-offs from communication systems down to circuits. To acquire the insight and understanding of the complex system and circuit trade-offs, a designer must digest volumes of books covering diverse topics, such as communications theory, radio propagation, and digital/analog/RF circuits. While books are available today that cover the individual areas, they tend to be narrowly focused and do not provide the necessary insight in the specific problem of integrating a complete radio system on a chip.

Applications of Viscoelasticity: Bituminous Materials Characterization and Modeling starts with an introduction to the theory of viscoelasticity, emphasizing its importance to various applications in material characterization and modeling. It next looks at constitutive viscoelastic functions, outlines basic equations for different loading conditions, and introduces the Boltzmann superposition principle, relaxation modulus, and creep compliance. Mechanical models, including integer-order and fractional-order are studied next, featuring real experimentation data alongside the benefits and drawbacks of using each model in various real-world scenarios. The book then covers the correspondence principle, followed by time-temperature superposition, featuring a simple procedure to construct a real master curve and challenges that might be encountered. The concluding chapters cover the Hopkins and Hamming, Park and Kim, and General Power law methods for interconversion of constitutive viscoelastic functions, applications of viscoelasticity for experimental tests, and incremental form of viscoelastic relations for numerical modeling. The book also includes supplementary codes that users can duplicate and use in their own work. Takes an applied approach to material viscoelasticity, explaining complicated viscoelastic equations and principles Presents examples of those equations and principles being applied to common problems in realworld settings Covers constitutive viscoelastic functions, including relaxation modulus and creep compliance Outlines the construction of a master curve of viscoelastic material considering time-temperature superposition Couples the correspondence principle with common viscoelastic experiments, such as threepoint bending beam, axial and torsional bar, and dynamic shear rheometer Provides supplementary codes

This book is a comprehensive exposition of FET modeling, and is a must-have resource for seasoned professionals and new graduates in the RF and microwave power amplifier design and modeling community. In it, you will find descriptions of characterization and measurement techniques, analysis methods, and the simulator implementation, model verification and validation procedures that are needed to produce a transistor model that can be used with confidence by the circuit designer. Written by semiconductor industry professionals with many years' device modeling experience in LDMOS and III-V technologies, this was the first book to address the modeling requirements specific to high-power RF transistors. A technology-independent approach

is described, addressing thermal effects, scaling issues, nonlinear modeling, and in-package matching networks. These are illustrated using the current market-leading high-power RF technology, LDMOS, as well as with III-V power devices.

Beyond 2020, wireless communication systems will have to support more than 1,000 times the traffic volume of today's systems. This extremely high traffic load is a major issue faced by 5G designers and researchers. This challenge will be met by a combination of parallel techniques that will use more spectrum more flexibly, realize higher spectral efficiency, and densify cells. Novel techniques and paradigms must be developed to meet these goals. The book addresses diverse key-point issues of next-generation wireless communications systems and identifies promising solutions. The book's core is concentrated to techniques and methods belonging to what is generally called radio access network.

Digital Terrain Analysis in Soil Science and Geology, Second Edition, synthesizes the knowledge on methods and applications of digital terrain analysis and geomorphometry in the context of multi-scale problems in soil science and geology. Divided into three parts, the book first examines main concepts, principles, and methods of digital terrain modeling. It then looks at methods for analysis, modeling, and mapping of spatial distribution of soil properties using digital terrain analysis, before finally considering techniques for recognition, analysis, and interpretation of topographically manifested geological features. Digital Terrain Analysis in Soil Science and Geology, Second Edition, is an updated and revised edition, providing both a theoretical and methodological basis for understanding and applying geographical modeling techniques. Presents an integrated and unified view of digital terrain analysis in both soil science and geology Features research on new advances in the field, including DEM analytical approximation, analytical calculation of local morphometric variables, morphometric globes, and two-dimensional generalized spectral analytical methods Includes a rigorous description of the mathematical principles of digital terrain analysis Provides both a theoretical and methodological basis for understanding and applying geographical modeling

The frequency-dependent characteristics of lossy interconnections such as on-chip metallization and wiring in multichip modules are characterized rigorously by 2D full-wave analyses using dyadic Green's functions. The frequency-dependent complex propagation constants and complex characteristic impedances for both single and coupled lossy transmission lines are obtained. Such transmission line parameters can be used in specialized circuit simulators to accurately characterize the lossy metal interconnections used in high speed and high frequency circuits. Effects of the frequency-dependent metal loss on signal propagation and coupling are then studied by circuit level simulations. The effects of common 3D structures in multilayer interconnections, such as vias and ground gaps, are studied by a 3D electromagnetic field solver using the transmission line matrix method and by experiments of large scale models. It is observed that electromagnetic waves that propagate in multilayer interconnections can excite other electromagnetic modes when they encounter discontinuities. This phenomenon, the excitation of different electromagnetic modes at discontinuities, is called mode conversion. Accurate and efficient equivalent circuit models of vias and ground gaps are developed and validated by experimental data. The mode conversion effects of multiple 3D discontinuities are investigated in detail. It is found that under certain conditions, the cumulative effects of unwanted mode conversion can be significant or catastrophic. Hence, layout of such interconnection structures must be carefully planned and accurately modeled during early design stages. With the aid of the developed models, design methodologies are investigated, such as the suppression of the unwanted mode conversion effects.

By 1990 the wireless revolution had begun. In late 2000, Mike Golio gave the world a significant tool to use in this revolution: The RF and Microwave Handbook. Since then, wireless technology spread across the globe with unprecedented speed, fueled by 3G and 4G mobile technology and the proliferation of wireless LANs. Updated to reflect this tremendous growth, the second edition of this widely embraced, bestselling handbook divides its coverage conveniently into a set of three books, each focused on a particular aspect of the technology. Six new chapters cover WiMAX, broadband cable, bit error ratio (BER) testing, high-power PAs (power amplifiers), heterojunction bipolar transistors (HBTs), as well as an overview of microwave engineering. Over 100 contributors, with diverse backgrounds in academic, industrial, government, manufacturing, design, and research reflect the breadth and depth of the field. This eclectic mix of contributors ensures that the coverage balances fundamental technical issues with the important business and marketing constraints that define commercial RF and microwave engineering. Focused chapters filled with formulas, charts, graphs, diagrams, and tables make the information easy to locate and apply to practical cases. The new format, three tightly focused volumes, provides not only increased information but also ease of use. You can find the information you need quickly, without wading through material you don't immediately need, giving you access to the caliber of data you have come to expect in a much more user-friendly format.

The approach adopted in Digital Synthesizers and Transmitters for Software Radio will provide an understanding of key areas in the field of digital synthesizers and transmitters. It is easy to include different digital techniques in the digital synthesizers and transmitters by using digital signal processing methods, because the signal is in digital form. By programming the digital synthesizers and transmitters, adaptive channel bandwidths, modulation formats, frequency hopping and data rates are easily achieved. Techniques such as digital predistortion for power amplifier linearization, digital compensation methods for analog I/Q modulator nonlinearities and digital power control and ramping are presented in this book. The flexibility of the digital synthesizers and transmitters makes them ideal as signal generators for software radio. Software radios represent a major change in the design paradigm for radios in which a large portion of the functionality is implemented through programmable signal processing devices, giving the radio the ability to change its operating parameters to accommodate new features and capabilities. A software radio approach reduces the content of radio frequency (RF) and other analog components of traditional radios and emphasizes digital signal processing to enhance overall transmitter flexibility. Software radios are emerging in commercial and military infrastructure.

Smart and Flexible Digital-to-Analog Converters proposes new concepts and implementations for flexibility and self-correction of current-steering digital-to-analog converters (DACs) which allow the attainment of a wide range of functional and performance specifications, with a much reduced dependence on the fabrication process. DAC linearity is analysed with respect to the accuracy of the DAC unit elements. A classification is proposed of the many different current-steering DAC correction methods. The classification reveals methods that do not yet exist in the open literature. Further, this book systematically analyses self-calibration correction methods for the various DAC mismatch errors. For instance, efficient calibration of DAC binary currents is identified as an important missing method. This book goes on to propose a new methodology for correcting mismatch errors of both nominally identical unary as well as scaled binary DAC

currents. A new concept for DAC flexibility is presented. The associated architecture is based on a modular design approach that uses parallel sub-DAC units to realize flexible design, functionality and performance. Two main concepts, self-calibration and flexibility, are demonstrated in practice using three DAC testchips in 250nm, 180nm and 40nm standard CMOS. Smart and Flexible Digital-to-Analog Converters will be useful to both advanced professionals and newcomers in the field. Advanced professionals will find new methods that are fully elaborated from analysis at conceptual level to measurement results at test-chip level. New comers in the field will find structured knowledge of fully referenced state-of-the art methods with many fully explained novelties.

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The four short years since Digital Communication over Fading Channels became an instant classic have seen a virtual explosion of significant new work on the subject, both by the authors and by numerous researchers around the world. Foremost among these is a great deal of progress in the area of transmit diversity and space-time coding and the associated multiple input-multiple output (MIMO) channel. This new edition gathers these and other results, previously scattered throughout numerous publications, into a single convenient and informative volume. Like its predecessor, this Second Edition discusses in detail coherent and noncoherent communication systems as well as a large variety of fading channel models typical of communication links found in the real world. Coverage includes single- and multichannel reception and, in the case of the latter, a large variety of diversity types. The moment generating function (MGF)-based approach for performance analysis, introduced by the authors in the first edition and referred to in literally hundreds of publications, still represents the backbone of the book's presentation. Important features of this new edition include:

- * An all-new, comprehensive chapter on transmit diversity, space-time coding, and the MIMO channel, focusing on performance evaluation
- * Coverage of new and improved diversity schemes
- * Performance analyses of previously known schemes in new and different fading scenarios
- * A new chapter on the outage probability of cellular mobile radiosystems
- * A new chapter on the capacity of fading channels
- * And much more

Digital Communication over Fading Channels, Second Edition is an indispensable resource for graduate students, researchers investigating these systems, and practicing engineers responsible for evaluating their performance.

Characterization and Modeling of Digital Circuits Second Edition Independently Published

An interim analysis of error pattern data collected at 4800 b/s and 9600 b/s via digital data transmission on AUTOVON using the Codex 9600 modem has been performed. The data tends to show that errors occur in dense bursts, ranging in length to thousands of bits with significant numbers of bursts of a few hundred bits length. The bursts are generally separated by long error-free intervals. The differences between the 4800 b/s and 9600 b/s data appear to be minimal with fewer bursts at 9600 b/s. No conclusions should be drawn in terms of a 4800 vs 9600 b/s comparison since the data considered in this interim report was not balanced in terms of numbers of bits collected at the different data rates or the different selected switch connections. When equal amounts of data are available for the various switch configurations it should then be possible to compare 4800 and 9600 b/s data. It has been demonstrated that an analytical channel model can be fit to the data, namely a MARKOV channel model. This model can be used for coding analysis by those who do not have the raw channel data and data analysis programs. (Author).

A concise introduction to the core concepts in digital communication, providing clarity and depth through examples, problems and MATLAB exercises. Its simple structure maps a logical route to understand the most basic principles in digital communication, and also leads students through more in-depth treatment with examples and step-by-step instructions.

Synthesis, Modelling and Characterization of 2D Materials and Their Heterostructures provides a detailed discussion on the multiscale computational approach surrounding atomic, molecular and atomic-informed continuum models. In addition to a detailed theoretical description, this book provides example problems, sample code/script, and a discussion on how theoretical analysis provides insight into optimal experimental design. Furthermore, the book addresses the growth mechanism of these 2D materials, the formation of defects, and different lattice mismatch and interlayer interactions. Sections cover direct band gap, Raman scattering, extraordinary strong light-matter interaction, layer-dependent photoluminescence, and other physical properties. Explains multiscale computational techniques, from atomic to continuum scale, covering different time and length scales Provides fundamental theoretical insights, example problems, sample code and exercise problems Outlines major characterization and synthesis methods for different types of 2D materials

This new edition updates the technologies that deal with the characterization of the thermal infrared radiation contrast between ground targets and backgrounds. Samples have been updated to comply with the current status of technology in sensor systems and countermeasures. New topics on mine detection and polarization have been included, and the section covering multispectral camouflage of personnel has been extended. The basic principles and meteorological parameters are presented, followed by calibration procedures, signature measurements, and data analyses.

Fractured rock is the host or foundation for innumerable engineered structures related to energy, water, waste, and transportation. Characterizing, modeling, and monitoring fractured rock sites is critical to the functioning of those infrastructure, as well as to optimizing resource recovery and contaminant management. Characterization, Modeling, Monitoring, and Remediation of Fractured Rock examines the state of practice and state of art in the characterization of fractured rock and the chemical and biological processes related to subsurface contaminant fate and transport. This report examines new developments, knowledge, and approaches to engineering at fractured rock sites since the publication of the 1996 National Research Council report Rock Fractures and Fluid Flow: Contemporary Understanding and Fluid Flow. Fundamental understanding of the physical nature of fractured rock has changed little since 1996, but many new characterization tools have been developed, and there is now greater appreciation for the importance of chemical and biological processes that can occur in the fractured rock environment. The findings of Characterization, Modeling, Monitoring, and Remediation of Fractured Rock can be applied to all types of engineered infrastructure, but especially to engineered repositories for buried or stored waste and to fractured rock sites that have been contaminated as a result of past disposal or other practices. The recommendations of this report are intended to help the practitioner, researcher, and decision maker take a more interdisciplinary approach to engineering in the fractured rock environment. This report describes how existing tools-some only recently developed-can be used to increase the accuracy and reliability of engineering design and management given the interacting forces of nature. With an interdisciplinary approach, it is possible to conceptualize and model the fractured rock environment with acceptable levels of uncertainty and reliability, and to design systems that maximize remediation and long-term performance. Better scientific understanding could inform regulations, policies, and implementation guidelines related to infrastructure development and operations. The recommendations for research and applications to enhance practice of this book make it a valuable resource for students and practitioners in this field.

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