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### **Y44NK4 - FREEMAN HOPE**

The ultimate handbook on microwave circuit design with CAD. Full of tips and insights from seasoned industry veterans, Microwave Circuit Design offers practical, proven advice on improving the design quality of microwave passive and active circuits-while cutting costs and time. Covering all levels of microwave circuit design from the elementary to the very advanced, the book systematically presents computer-aided methods for linear and nonlinear designs used in the design and manufacture of microwave amplifiers, oscillators, and mixers. Using the newest CAD tools, the book shows how to design transistor and diode circuits, and also details CAD's usefulness in microwave integrated circuit (MIC) and monolithic microwave integrated circuit (MMIC) technology. Applications of nonlinear SPICE programs, now available for microwave CAD, are described. State-of-the-art coverage includes microwave transistors (HEMTs, MODFETs, MESFETs, HBTs, and more), high-power amplifier design, oscillator design including feedback topologies, phase noise and examples, and more. The techniques presented are illustrated with several MMIC designs, including a wideband amplifier, a low-noise amplifier, and an MMIC mixer. This unique, one-stop handbook also features a major case study of an actual anticollision radar transceiver, which is compared in detail against CAD predictions; examples of actual circuit designs with photographs of completed circuits; and tables of design formulae.

A frequency synthesizer is an electronic system for generating any of a range of frequencies from a single fixed oscillator. They are found in modern devices like radio receivers, mobile phones, and GPS systems. This comprehensive resource offers RF and microwave engineers a thorough overview of both well-established and recently developed frequency synthesizer design techniques. Professionals find expert guidance on all design aspects, including main architectures, key building blocks, and practical circuit implementation. Engineers learn the development process and gain a solid understanding of how to build a synthesizer from a basic diagram to the final product. Starting with a simple single-loop PLL example, the book progressively examines various alternatives -- fractional-N, DDS, frequency offset, multiloop and more OCO to achieve required performance objectives. This unique volume gathers a collection of block diagrams, clever circuits, design recipes, and other hard-to-find information that is usually treated as OCO design secretsOCO. Written in a simple yet rigorous style with numerous illustrations, the book is an all-in-one reference for both beginner and experienced designers.

Written by an internationally recognized as an expert on the subject of microwave (MW) tubes, this book presents and describes the many types of microwave tubes, and despite competition from solid-state devices (those using GaN, SiC, et cetera), which continue to be used widely and find new applications in defense, communications, medical, and industrial drying. Helix traveling wave tubes (TWTs), as well as coupled cavity TWTs are covered. Klystrons, and how they work, are described, along with the physics behind it and examples of devices and their uses. Vacuum electron devices are explained in detail and examines the harsh environment that must exist in tubes if they are to operate properly. The secondary emission process and its role in the operation of crossed-field devices is also discussed. The design of collectors for linear-beam tubes, including power dissipation and power recovery, are explored. Discussions of important noise sources and techniques that can be used to minimize their effects are also included. Presented in full color, this book contains a balance of practical and theoretical material so that those new to microwave tubes as well as experienced microwave tube technicians, engineers, and managers can benefit from its use.

This book presents case studies to illustrate that careful modeling of the assembly characteristics and layout details is required to bring simulations and measurements into agreement. Engineers learn how to use a proper combination of isolation structures and circuit techniques to make analog/RF circuits more immune to substrate noise. Topics include substrate noise propagation, passive isolation structures, noise couple in active devices, measuring the coupling mechanisms in analog/RF circuits, prediction of the impact of substrate noise on analog/RF circuits, and noise coupling in analog/RF systems.

This updated and greatly expanded second edition of the popular text RF Circuit Design: Theory and Applications provides a comprehensive coverage of the fundamental concepts of high-frequency circuit analysis and design. Each of the 10 chapters includes a Practically Speaking section in which the authors present realistic circuit examples. These carefully worked out circuits enable the reader to directly apply the theoretical aspects developed in this text. The text is self-contained and requires only a minimum amount of analog circuit design and electromagnetics; it is well-suited for junior and senior-level undergraduates as well as practicing engineers.

This classic text is an excellent resource and time-saver for engineers who need to tackle troublesome nonlinear components that remain in use despite recent advances in microwave technology. NONLINEAR MICROWAVE CIRCUITS offers detailed, technically substantial coverage of key methods for the analysis, design, and optimization of nonlinear microwave circuits. Using minimal mathematics, it integrates in-depth, "readable" coverage of the underlying theories that guide these methods. This book is replete with valuable "how to" information on a wide range of topics.

This comprehensive resource provides a thorough introduction to the principles of electronic circuits operating in the radio, microwave, and millimeter-wave frequency ranges. The book highlights the fundamental physical laws of classical electromagnetics using a foundation of Maxwell's equations to give insight into the operating principles of circuit elements of all kinds, from lumped elements to transmission lines, waveguides, optical

fibers, and quasi-optical structures. Standard passive system components like filters, splitters, couplers, hybrids, baluns, and antennas are explained to acclimate the reader to considering multiple technological solutions for common design problems. A basic overview of active circuit designs, such as amplifiers, mixers, and multipliers is also provided, along with discussion of the performance characteristics of electronic systems, including noise and linearity. Emphasis is placed on visualization and understanding of how and why electronic circuits of all frequencies are built and operate the way they do. Readers learn how to match an amplifier for optimum noise performance over the broadest bandwidth with the fewest number of elements and how to visualize the coupling of various modes in a mixed waveguide-type structure and avoid resonances due to trapped, higher-order modes. The book provides the tools needed to design and optimize a launcher from microstrip into waveguide, and whether the best characteristics can be achieved by incorporating matching elements in the microstrip section, the waveguide section, or both. Packed with references and examples, readers learn not only how to do the math but what the math means.

This book focuses on components such as filters, transformers, amplifiers, mixers, and oscillators. Even the phase lock loop chapter (the last in the book) is oriented toward practical circuit design, in contrast to the more systems orientation of most communication texts.

Summarizes the schemes and technologies in RF circuit design, describes the basic parameters of an RF system and the fundamentals of RF system design, and presents an introduction of the individual RF circuit block design. Forming the backbone of today's mobile and satellite communications networks, radio frequency (RF) components and circuits are incorporated into everything that transmits or receives a radio wave, such as mobile phones, radio, WiFi, and walkie talkies. RF Circuit Design, Second Edition immerses practicing and aspiring industry professionals in the complex world of RF design. Completely restructured and reorganized with new content, end-of-chapter exercises, illustrations, and an appendix, the book presents integral information in three complete sections: Part One explains the different methodologies between RF and digital circuit design and covers voltage and power transportation, impedance matching in narrow-band case and wide-band case, gain of a raw device, measurement, and grounding. It also goes over equipotentiality and current coupling on ground surface, as well as layout and packaging, manufacturability of product design, and radio frequency integrated circuit (RFIC). Part Two includes content on the main parameters and system analysis in RF circuit design, the fundamentals of differential pair and common-mode rejection ratio (CMRR), Balun, and system-on-a-chip (SOC). Part Three covers low-noise amplifier (LNA), power amplifier (PA), voltage-controlled oscillator (VCO), mixers, and tunable filters. RF Circuit Design, Second Edition is an ideal book for engineers and managers who work in RF circuit design and for courses in electrical or electronic engineering.

The art of RF circuit design made simple... Radio Frequency circuits are the fundamental building blocks in a vast array of consumer electronics and wireless communication devices. Jeremy Everard's unique combination of theory and practice provides insight into the principles of operation, together with invaluable guidance to developing robust and long-lasting circuit designs. Features include: \* Simplified approach to RF circuit theory and device modelling using algebraic approximations to illustrate the important underlying principles. \* A comprehensive design guide to low noise oscillators backed by a full theoretical treatment, based on the author's latest research, and including extensive design examples. \* Key concepts of broad and narrow band small signal amplifiers, mixers, and high-efficiency broadband power amplifier design. \* How to develop large signal circuit models with simulation and tuning in real time. \* Charts of performance parameters for RF chip components. Advanced undergraduate and postgraduate students in RF and microwave circuit design will benefit from the practical and highly illustrative approach. Design and research engineers and industrial technical managers, will appreciate the basic and detailed theory, analysis, design and operation of RF and microwave circuits.

This new edition of a previous bestseller gives you practical techniques for optimizing RF and microwave circuits for applications in radar systems design, with an emphasis on current and emerging technologies. Completely updated with new material, the book shows you how to design RF components for radar systems and how to choose appropriate materials and packaging methods. It takes you through classic techniques, to the state of the art, and finally to emerging technologies. You will learn: How to design high-frequency circuits for use in radar applications How to integrate components while avoiding higher-level assembly issues and troubleshooting problems on the measurement bench How to properly simulate, build, assemble, and test high-frequency circuits How to debug issues with hardware on the bench How to connect microwave theory to practical circuit design Theory and practical information are provided while addressing topics ranging from heat removal to digital circuit integration. The book serves as a teaching aid for classic techniques that are still relevant today. It also demonstrates how these techniques are serving as the foundation for technologies to come. You will be equipped to consider future needs and emerging enabling technologies and confidently think (and design) outside the box to ensure future needs are met. The book also shows you how to incorporate modern design techniques often overlooked or underused, and will help you to better understand the capabilities and limitations of today's technology and the emerging technologies that are on the horizon to mitigate those limitations. This is a must-have resource for system-level radar designers who want to up their game in RF/microwave component design. It is also a great tool for RF/microwave engineers tasked or interested in designing components for radar systems. Students and new designers of radar components will also benefit and be well prepared to start designing immediately.

**BUILD THE CIRCUITS THAT MAKE WIRELESS WORK** If you like hands-on electronics, you'll love Secrets of RF Circuit Design, Third Edition, by Popular Electronics writer Joe Carr. This update of the favorite RF circuit guide of thousands of electronics enthusiasts takes you inside wireless technology

with step-by-step, illustrated directions for dozens of usable projects. This super guide demonstrates RF theory as it shows you how to overcome the technical and materials challenges facing those who build real-world electronics. You learn how to design and build receiver circuits, RF bridges, amplifiers, receiver preselectors, simple spectrum analyzers, and time domain reflectometers. You get detailed insights into simple RF instruments, as well as UHF and microwave components...complete troubleshooting guidance...and handy parts lists and components sources. This new edition packs the latest information on directional and hybrid couplers, and seven new chapters on demodulators, circuit vectors, measuring L-C circuits, and filtering circuits against EMI. "...a great book on wireless technology for persons starting out in RF electronics, as well as for RF technicians and ham radio operators." ---Cotter W. Sayre, author of *The Complete RF Technician's Handbook* (Amazon.com review)

This newly revised and expanded edition of the 2003 Artech House classic, *Radio Frequency Integrated Circuit Design*, serves as an up-to-date, practical reference for complete RFIC know-how. The second edition includes numerous updates, including greater coverage of CMOS PA design, RFIC design with on-chip components, and more worked examples with simulation results. By emphasizing working designs, this book practically transports you into the authors' own RFIC lab so you can fully understand the function of each design detailed in this book. Among the RFIC designs examined are RF integrated LC-based filters, VCO automatic amplitude control loops, and fully integrated transformer-based circuits, as well as image reject mixers and power amplifiers. If you are new to RFIC design, you can benefit from the introduction to basic theory so you can quickly come up to speed on how RFICs perform and work together in a communications device. A thorough examination of RFIC technology guides you in knowing when RFICs are the right choice for designing a communication device. This leading-edge resource is packed with over 1,000 equations and more than 435 illustrations that support key topics."

This thoroughly updated leading-edge circuit design resource offers the knowledge needed to quickly pinpoint transmission problems that can compromise the entire circuit design. This new edition demonstrates how to apply EM theory to solve signal integrity problems with a practical application-oriented approach. Discussing both design and debug issues at gigabit per second data rates, the book serves as a practical reference for projects involving high-speed serial signaling on printed wiring boards. Step-by-step, this book goes from reviewing the essentials of linear circuit theory, to examining practical issues of pulse propagation along lossless and lossy transmission lines. It provides detailed guidelines for crosstalk, attenuation, power supply decoupling, and layer stackup tradeoffs (including pad/antipad tradeoffs). Other key topics include the construction of etched conductors, analysis of return paths and split planes, microstrip and stripline characteristics, and SMT capacitors. Filled with on-the-job-proven examples, this hands-on reference is the book that engineers can turn to time and again to design out and troubleshoot circuit signal loss and impedance problems.

This book presents and discusses alternatives to ordinary transmission lines for the design and implementation of advanced RF/microwave components in planar technology. This book is devoted to the analysis, study and applications of artificial transmission lines mostly implemented by means of a host line conveniently modified (e.g., with modulation of transverse dimensions, with etched patterns in the metallic layers, etc.) or with reactive loading, in order to achieve novel device functionalities, superior performance, and/or reduced size. The author begins with an introductory chapter dedicated to the fundamentals of planar transmission lines. Chapter 2 is focused on artificial transmission lines based on periodic structures (including non-uniform transmission lines and reactively-loaded lines), and provides a comprehensive analysis of the coupled mode theory. Chapters 3 and 4 are dedicated to artificial transmission lines inspired by metamaterials, or based on metamaterial concepts. These chapters include the main practical implementations of such lines and their circuit models, and a wide overview of their RF/microwave applications (including passive and active circuits and antennas). Chapter 5 focuses on reconfigurable devices based on tunable artificial lines, and on non-linear transmission lines. The chapter also introduces several materials and components to achieve tuning, including diode varactors, RF-MEMS, ferroelectrics, and liquid crystals. Finally, Chapter 6 covers other advanced transmission lines and wave guiding structures, such as electroinductive-/magnetoinductive-wave lines, common-mode suppressed balanced lines, lattice-network artificial lines, and substrate integrated waveguides. *Artificial Transmission Lines for RF and Microwave Applications* provides an in-depth analysis and discussion of artificial transmission lines, including design guidelines that can be useful to researchers, engineers and students.

This new edition of the classic RF circuit design book is updated from a "wire lead," discrete components, Smith Charts book to one that covers today's IC and system-level design issues.

An intermediate-level guide to designing, building and testing all types of radio frequency circuits. The book includes functional projects that demonstrate the principles of RF circuits, parts lists and sources of components.

This book, first published in 2004, is an expanded and revised edition of Tom Lee's acclaimed RFIC text.

Essential reading for experts in the field of RF circuit design and engineers needing a good reference. This book provides complete design procedures for multiple-pole Butterworth, Chebyshev, and Bessel filters. It also covers capacitors, inductors, and other components with their behavior at RF frequencies discussed in detail. \*Provides complete design procedures for multiple-pole Butterworth, Chebyshev, and Bessel filters \*Covers capacitors, inductors, and other components with their behavior at RF frequencies discussed in detail

This second edition of *An Engineer's Guide to Automated Testing of High-Speed Interfaces* provides updates to reflect current state-of-the-art high-speed digital testing with automated test equipment technology (ATE). Featuring clear examples, this one-stop reference covers all critical aspects of automated testing, including an introduction to high-speed digital basics, a discussion of industry standards, ATE and bench instrumentation for digital applications, and test and measurement techniques for characterization and production environment. Engineers learn how to apply automated test equipment for testing high-speed digital I/O interfaces and gain a better understanding of PCI-Express 4, 100Gb Ethernet, and MIPI while exploring the correlation between phase noise and jitter. This updated resource provides expanded material on 28/32 Gbps NRZ testing and wireless testing that are becoming increasingly more pertinent for future applications. This book explores the current trend of merging high-speed digital testing within the fields of photonic and wireless testing.

This authoritative new resource presents practical techniques for optimizing RF and microwave circuits for applications in radar systems design with an emphasis on current and emerging technologies. Professionals learn how to design RF components for radar systems and how to choose appropriate

materials and packaging methods. This book explains how to integrate components while avoiding higher-level assembly issues and troubleshooting problems on the measurement bench. Theory and practical information are provided while addressing topics ranging from heat removal to digital circuit integration. This book is divided into three sections: the first section introduces the basics of microwave design, including transmission line theory and common materials used in RF circuits. The methods for creating accurate device models for both passive and active circuits are presented. The second part details the design of power amplifiers, low noise amplifiers, and passive elements. Both conventional and state-of-the-art design techniques are included with ample 'tips and tricks.' The last section concludes with a focus on component integration providing details on design methods for military operations, high manufacturing yield, and preventing measurement issues.

This comprehensive resource explains the theory of RF circuits and systems and the practice of designing them. The fundamentals for linear and low noise amplifier designs, including the S and noise parameters and their applications in amplifier designs and matching network designs using the Smith chart are covered. Theories of RF power amplifiers and high efficiency power amplifiers are also explained. The underpinnings of wireless communications systems as well as passive components commonly used in RF circuits and measurements are discussed. RF measurement techniques and RF switches are also presented. The book explores stability criteria and the invariant property of lossless networks and includes detailed theoretical treatments. The basic concepts and techniques covered in this book are routinely used in today's engineering practice, especially from the perspective of printed circuit board (PCB) based RF circuit design and system integration. Intended for practicing engineers and circuit designers, this book focuses on practical topics in circuit design and measurement techniques. It bridges the gap between academic materials and real circuit designs using real circuit examples and practical tips. Readers develop a numerical feel for RF problems as well as awareness of the concepts of design for cost and design for manufacturing, which is a critical skill set for today's engineers working in an environment of commercial product development.

This is a rigorous tutorial on radio frequency and microwave power amplifier design, teaching the circuit design techniques that form the microelectronic backbones of modern wireless communications systems. Suitable for self-study, corporate training, or Senior/Graduate classroom use, the book combines analytical calculations and computer-aided design techniques to arm electronic engineers with every possible method to improve their designs and shorten their design time cycles.

Here's an authoritative resource that offers you valuable assistance with your work involving microwave circuit analysis and design. This practical book provides a thorough understanding of the properties of planar transmission lines for integrated circuits. It presents matrix and computer-aided methods for analysis and design of circuit components. You find in-depth details on input, output, and interstage networks, as well as coverage of stability, noise, and signal distortion. Moreover, this unique book is the first to explore and develop the interface between lumped-element circuits and distributed element circuits. Supported with over 580 equations and 100 illustrations, this volume presents the necessary technological underpinnings and all the practical details you need to fully comprehend and work with the material.

This new resource presents readers with all relevant information and comprehensive design methodology of wideband amplifiers. This book specifically focuses on distributed amplifiers and their main components, and presents numerous RF and microwave applications including well-known historical and recent architectures, theoretical approaches, circuit simulation, and practical implementation techniques. A great resource for practicing designers and engineers, this book contains numerous well-known and novel practical circuits, architectures, and theoretical approaches with detailed description of their operational principles.

Presents a comprehensive overview and analysis of the recent developments in signal processing for Chipless Radio Frequency Identification Systems This book presents the recent research results on Radio Frequency Identification (RFID) and provides smart signal processing methods for detection, signal integrity, multiple-access and localization, tracking, and collision avoidance in Chipless RFID systems. The book is divided into two sections: The first section discusses techniques for detection and denoising in Chipless RFID systems. These techniques include signal space representation, detection of frequency signatures using UWB impulse radio interrogation, time domain analysis, singularity expansion method for data extraction, and noise reduction and filtering techniques. The second section covers collision and error correction protocols, multi-tag identification through time-frequency analysis, FMCW radar based collision detection and multi-access for Chipless RFID tags as well as localization and tag tracking. Describes the use of UWB impulse radio interrogation to remotely estimate the frequency signature of Chipless RFID tags using the backscatter principle Reviews the collision problem in both chipped and Chipless RFID systems and summarizes the prevailing anti-collision algorithms to address the problem Proposes state-of-the-art multi-access and signal integrity protocols to improve the efficacy of the system in multiple tag reading scenarios Features an industry approach to the integration of various systems of the Chipless RFID reader-integration of physical layers, middleware, and enterprise software Chipless Radio Frequency Identification Reader Signal Processing is primarily written for researchers in the field of RF sensors but can serve as supplementary reading for graduate students and professors in electrical engineering and wireless communications.

Circulator design has advanced significantly since the first edition of this book was published 25 years ago. The objective of this second edition is to present theory, information, and design procedures that will enable microwave engineers and technicians to design and build circulators successfully. This resource contains a discussion of the various units used in the circulator design computations, as well as covers the theory of operation. This book presents numerous applications, giving microwave engineers new ideas about how to solve problems using circulators. Design examples are provided, which demonstrate how to apply the information to real-world design tasks.

This authoritative new resource provides an overview and introduction to working with RF, microwave, and high frequency components. From transmission lines, antennas, millimeter waves, ferrites, hybrids, power dividers and filters, this book focuses on practical, time-to-market issues to help with projects in the field. Keeping mathematics to a minimum, this comprehensive volume is packed with over 700 illustrations that help clarify key concepts. The reader will gain an in-depth understanding of the special characteristics exploited in microwave and high frequency design. The book is also used in industrial training courses.

Essential reading for experts in the field of RF circuit design and engineers needing a good reference. This book provides complete design procedures

for multiple-pole Butterworth, Chebyshev, and Bessel filters. It also covers capacitors, inductors, and other components with their behavior at RF frequencies discussed in detail. Provides complete design procedures for multiple-pole Butterworth, Chebyshev, and Bessel filters Covers capacitors, inductors, and other components with their behavior at RF frequencies discussed in detail

This authoritative resource provides you with comprehensive and detailed coverage of the wave approach to microwave network characterization, analysis, and design using scattering parameters. For the first time in any book, all aspects and approaches to wave variables and the scattering matrix are explored. The book compares and contrasts voltage waves, travelling waves, pseudo waves, and power waves, and explains the differences between real scattering parameters, pseudo scattering parameters, and power scattering parameters. You find important discussions on standard scattering matrices and wave quantities, mixed mode wave variables, and noise wave variables with noise wave correlation matrices. Moreover, the book presents clear methods for standard single ended multiport network design and noise analysis. This in-depth reference is packed with over 1,100 equations and numerous illustrations.

This book is intended for senior undergraduate and graduate students as well as practicing engineers who are involved in design and analysis of radio frequency (RF) circuits. Detailed tutorials are included on all major topics required to understand fundamental principles behind both the main sub-circuits required to design an RF transceiver and the whole communication system. Starting with review of fundamental principles in electromagnetic (EM) transmission and signal propagation, through detailed practical analysis of RF amplifier, mixer, modulator, demodulator, and oscillator circuit topologies, all the way to the system communication theory behind the RF transceiver operation, this book systematically covers all relevant aspects in a way that is suitable for a single semester university level course.

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A unique, state-of-the-art guide to wireless integrated circuit design. With wireless technology rapidly exploding, there is a growing need for circuit design information specific to wireless applications. Presenting a single-source guidebook to this dynamic area, industry expert Ulrich Rohde and writer David Newkirk provide researchers and engineers with a complete set of modeling, design, and implementation tools for tackling even the newest IC technologies. They emphasize practical design solutions for high-performance devices and circuitry, incorporating ample examples of novel and clever circuits from high-profile companies. They also provide excellent appendices containing working models and CAD-based applications. RF/Microwave Circuit Design for Wireless Applications offers:

- \* Introduction to wireless systems and modulation types
- \* A systematic approach that differentiates between designing for battery-operated devices and base-station design
- \* A comprehensive introduction to semiconductor technologies, from bipolar transistors to CMOS to GaAs MESFETs
- \* Clear guidelines for obtaining the best performance in discrete and integrated amplifier design
- \* Detailed analysis of available mixer circuits applicable to the wireless frequency range
- \* In-depth explanations of oscillator circuits, including microwave oscillators and ceramic-resonator-based oscillators
- \* A thorough evaluation of all components of wireless synthesizers

RF and Microwave Transmitter Design is unique in its coverage of both historical transmitter design and cutting edge technologies. This text explores

the results of well-known and new theoretical analyses, while informing readers of modern radio transmitters' practical designs and their components. Jam-packed with information, this book broadcasts and streamlines the author's considerable experience in RF and microwave design and development.

The products that drive the wireless communication industry, such as cell phones and pagers, employ circuits that operate at radio and microwave frequencies. Following on from a highly successful first edition, the second edition provides readers with a detailed introduction to RF and microwave circuits. Throughout, examples from real-world devices and engineering problems are used to great effect to illustrate circuit concepts. \* Takes a top-down approach, describing circuits in the overall context of communication systems. \* Presents expanded coverage of waveguides and FT mixers. \* Discusses new areas such as oscillators design and digital communication. \* An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

A much-needed, up-to-date guide to the rapidly growing area of RF circuit design, this book walks readers through a whole range of new and improved techniques for the analysis and design of receiver and transmitter circuits, illustrating them through examples from modern-day communications systems. The application of MMIC to RF design is also discussed.

Radio-Frequency Integrated-Circuit Engineering addresses the theory, analysis and design of passive and active RFIC's using Si-based CMOS and Bi-CMOS technologies, and other non-silicon based technologies. The materials covered are self-contained and presented in such detail that allows readers with only undergraduate electrical engineering knowledge in EM, RF, and circuits to understand and design RFICs. Organized into sixteen chapters, blending analog and microwave engineering, Radio-Frequency Integrated-Circuit Engineering emphasizes the microwave engineering approach for RFICs. • Provides essential knowledge in EM and microwave engineering, passive and active RFICs, RFIC analysis and design techniques, and RF systems vital for RFIC students and engineers • Blends analog and microwave engineering approaches for RFIC design at high frequencies • Includes problems at the end of each chapter

Despite its continuing popularity, the so-called standard circuit model of compound semiconductor field-effect transistors (FETs) and high electron mobility transistors (HEMTs) is shown to have a limitation for nonlinear analysis and design: it is valid only in the static limit. When the voltages and currents are time-varying, as they must be for these devices to have any practical use, the model progressively fails for higher specification circuits. This book shows how to reform the standard model to render it fully compliant with the way FETs and HEMTs actually function, thus rendering it valid dynamically. Proof-of-principle is demonstrated for several practical circuits, including a frequency doubler and amplifiers with demanding performance criteria. Methods for extracting both the reformulated model and the standard model are described, including a scheme for re-constructing from S-parameters the bias-dependent dynamic (or RF) I(V) characteristics along which devices work in real-world applications, and as needed for the design of nonlinear circuits using harmonic-balance and time-domain simulators. The book includes a historical review of how variations on the standard model theme evolved, leading up to one of the most widely used—the Angelov (or Chalmers) model.