This book describes a new design methodology that allows optimization-based synthesis of RF systems in a hierarchical multilevel approach, in which the system is designed in a bottom-up fashion, from the device level up through the subsystem level. At each level of the design hierarchy, the authors discuss methods that increase the design robustness and improve the accuracy and efficiency of the simulations. The methodology described enables circuit design and layout in a complete and automated integrated manner, achieving optimized designs in significantly less time than previously. It also provides a methodology to design automatic and accurate syntheses of RF systems, starting from the device to the system level. Discusses analytical and machine learning techniques for modeling and optimization and uses such models in synthesis approaches. Compares synthesis strategies for RF circuits based on bottom-up versus flat approaches. Discusses layout-aware bottom-up design methodologies for RF circuits. Discusses variability-aware bottom-up design methodologies for RF circuits. Describes multilevel bottom-up design methodologies from the device up to the system level.

Electric Power Transformer Engineering, Third Edition expounds the latest information and developments to engineers who are familiar with basic principles and applications, including a hands-on working knowledge of power transformers. Targeting all from the merely curious to seasoned professionals and acknowledged experts, its content is structured to enable readers to easily access essential material in order to appreciate the many facets of an electric power transformer. Topically structured in three parts, the book illustrates for electrical engineers the relevant theories and principles (concepts and mathematics) of power transformers. Devotes complete chapters to each of 10 particular embodiments of power transformers, including power, distribution, phase-shifting, rectifier, dry-type, and instrument transformers, as well as step-voltage regulators, constant-voltage transformers, transformers for wind turbine generators and photovoltaic applications, and reactors. Addresses 14 ancillary topics including insulation, bushings, load tap changers, thermal performance, testing, protection, audible sound, failure analysis, installation and maintenance and more. As with the other books in the series, this one supplies a high level of detail and, more importantly, a tutorial style of writing and use of photographs and graphics to help the reader understand the material. Important chapters have been retained from the second edition; most have been significantly expanded and updated for this third installment. Each chapter is replete with photographs, equations, and tabular data, and this edition includes a new chapter on transformers for use with wind turbine generators and distributed photovoltaic arrays. Jim Harlow and his esteemed group of contributors offer a glimpse into the enthusiastic community of power transformer engineers responsible for this outstanding and best-selling work. A volume in the Electric Power Engineering Handbook, Third Edition. Other volumes in the set: K12642 Electric Power Generation, Transmission, and Distribution, Third Edition (ISBN: 9781498565284) K12648 Power Systems, Third Edition (ISBN: 9781498565338) K13917 Power System Stability and Control, Third Edition (ISBN: 9781498832024) K12650 Electric Power Substations Engineering, Third Edition (ISBN: 9781498565383) Watch James H. Harlow's talk about his book: Part One: http://youtu.be/fZNe9L4cux0 Part Two: http://youtu.be/yULZ99O5E Part Three: http://youtu.be/nQWWxK27_dg

As integrated circuit (IC) feature sizes scale below a quarter of a micron, thereby defining the deep submicron (DSM) era, there began a gradual shift in the impact on performance due to the metal interconnections among the active circuit components. Once viewed as merely parasitics in terms of their relevance to the overall circuit performance, the interconnect can now have a dominant impact on system design, performance and yield. Beginning in the late 1980's there was significant research toward better modeling and characterization of the resistance, capacitance and ultimately the inductance of chip interconnect. IC Interconnect Analysis covers the state-of-the-art methods for modeling and analyzing IC interconnect based on the past fifteen years of research. This is done at a level suitable for most practitioners who work in the semiconductor and electronic design automation fields, but also includes significant depth for the research professionals who will ultimately extend this work into other areas and applications. IC Interconnect Analysis begins with an in-depth coverage of delay metrics, including the ubiquitous Elmore delay and its many variations. This is followed by an outline of matching methods, calculating moments efficiently, and Krylov subspace methods for model order reduction. The final two chapters describe how to interface these reduced-order models to circuit simulators and gate-level timing analyzers respectively. IC Interconnect Analysis is written for CAD tool developers, IC designers and graduate students.

This book contains the revised contributions of all the speakers of the fifth AACD Workshop which was held in Lausanne on April 2-4, 1996. It was organized by Dr. Viadro Velacene of the EPFL University and MEAD of Lausanne. The program consisted of six tutorials per day over three days. The tutorials were presented by experts in the field. They were selected by a program committee consisting of Prof. Willy Sansen of the Katholieke Universiteit Leuven, Prof. Rudy van de Plasche of Philips Research and the University of Technology Eindhoven and Prof. 10han Huising of the Delft University of Technology. The three topics mentioned above have been selected because of their importance in present days analog design.

Combining select chapters from Grigsby's standard-setting The Electric Power Engineering Handbook with several chapters not found in the original work, Electric Power Transformer Engineering became widely popular for its comprehensive, tutorial-style treatment of the theory, design, analysis, operation, and protection of power transformers. For its second edition; most have been significantly expanded and updated for this third installment. This book contains the revised contributions of all the speakers of the fifth AACD Workshop which was held in Lausanne on April 2-4, 1996. It was organized by Dr. Viadro Velacene of the EPFL University and MEAD of Lausanne. The program consisted of six tutorials per day over three days. The tutorials were presented by experts in the field. They were selected by a program committee consisting of Prof. Willy Sansen of the Katholieke Universiteit Leuven, Prof. Rudy van de Plasche of Philips Research and the University of Technology Eindhoven and Prof. 10han Huising of the Delft University of Technology. The three topics mentioned above have been selected because of their importance in present days analog design.
The other topics that have been discussed before are: in 1992: Operational amplifiers Analog to digital converters Analog computer aided design in 1993: Mixed AID circuit design Sensor interface circuits Communication circuits in 1994: Low-power low-voltage design Integrated circuits Integrate filters Smart power technology in 1995: Low-noise, low-power, low-voltage design Mixed-signal design with CAD tools voltage, current, and time references Each AACD workshop has given rise to the publication of a book by Kluwer entitled “Analog Circuit Design”. This is the fifth book. This series of books provides a valuable overview of all analog circuit design techniques and achievements. It is a reference for anyone engaged in this discipline.

This book focuses on strengthening and joining materials by means of plastic deformation, gathering extended research papers presented at the AIMTD 2016 conference. Plastic deformation is used in materials processing to improve the strength of the material. For example, the rod/screw used to connect the cooker handle to the main body has to be strong and sustainable; such rods can be strengthened by plastic deformation (using multi-stage forming operations etc.). Similarly, joining by means of plastic deformation is highly valuable since it avoids the material and environmental degradation often caused by fusion welding processes. The book discusses various processing techniques in which plastic deformation is used to strengthen materials – e.g. in equal channel angular extrusion, autofrettage etc., or to join materials without melting them – e.g. riveting, riveting, riveting. In this new edition, each chapter begins with a brief description of the main methods and applications, and incident field excitement, now has a chapter concerning two-conductor lines followed immediately by a chapter on MTLs for that topic. This enables instructors to emphasize two-conductor or MTLs or both. In addition to the organization of the material, this Second Edition now contains important advancements in analysis methods that have developed since the previous edition, such as methods for achieving signal integrity (SI) in high-speed digital interconnects, the finite-difference, time-domain (FDTD) solution methods, and the time-domain to frequency-domain transformation (TDFD) method. Furthermore, the content of Chapters 8 and 9 on digital signal propagation and signal integrity application has been considerably expanded upon to reflect all of the vital information current and future designers of high-speed digital systems need to know. Complete with an accompanying FTP site, appendices with descriptions of numerous FORTRAN computer codes that implement all the techniques in the text, and a brief but thorough tutorial on the SPICE/PSPICE circuit analysis program, Analysis of Multiconductor Transmission Lines, Second Edition is an indispensable textbook for students and a valuable resource for industry professionals.

The book addresses the critical challenges faced by the ever-expanding wireless communication market and the increasing frequency of operation due to continuous innovation of high performance integrated passive devices. The challenges lie in low quality factor, design complexity, manufacturability, processing cost, etc., are studied with examples and specifics. Silicon on-chip inductors were first reported in 1989 by Nguyen and Meyer in a 0.8 μm silicon bipolar complementary metal oxide semiconductor technology (BiCMOS). Since then, there has been an enormous progress in the research on the performance design, optimization, and design-for-integration, quality factor, etc., of spiral inductors and significant results are reported in literature for various applications. This book introduces an efficient method of determining the characteristic spiral inductor performance and the effects of the design like quality factor, die size, interlayer parasitic effect, and inductance, quality factor and operating frequency, maximum quality factor and the peak frequency is also explored. The authors proposed an algorithm for accurate design and optimization of spiral inductors using a 3D electromagnetic simulator with minimum number of inductor structure simulations and thereby reducing its long computation time. A new multilayer pyramidal symmetric inductor structure is also proposed in this book. Being multilevel, the proposed inductor achieves high inductance to area ratio and hence occupies smaller silicon area.

This book offers a comprehensive treatment of the fundamentals of solar cells and their use in the photovoltaic (PV) technology, a major constituent of renewable sources of energy. It discusses the nature and measurement of solar radiation, methods for characterization of solar cells and determination of their parameters. The book describes the principle of operation of different types of inverters used in PV systems and also illustrates the design, construction and performance of photovoltaic operated systems such as the solar lantern, solar water pump, solar inverter and a general solar power system. Besides, it explains the process of uploading of power generated by solar arrays to the power grid for onwards transmission to distant locations. The economic aspects of the PV systems and their conventionally operated counterparts are also dealt with. The design procedure given in the book enables the reader to configure the desired PV system without the help of high priced patented software. The text is intended for a course on PV technologies undertaken by the undergraduate and postgraduate students of Electrical Engineering, Energy Studies, and Mechanical Engineering. It is very useful for teaching the important fundamentals of photovoltaic technology. KEY FEATURES: About one hundred figures, fifty circuit diagrams and several design examples are given. A large number of problems are given at the end of some chapters. References are provided for further study and research.

Microwave/RF Apparatus and Probes for Material Heating, Sensing, and Plasma Generation, Second Edition, encompasses the area of high-frequency apparatus and probes for material interactions as an integrated science. Based on practical experience rather than entirely on theoretical concepts, and enhancing phenomenological explanations and well-annotated figures, the book represents one of the most important resources on the topics of microwave technologies, applications of RF and microwaves in industry (industrial heating and drying), and microwave engineering. After covering the basics of field-material interactions, the book reviews and categorizes probes and applicators, demonstrates their real-world applications, and offers numerically solved examples. Readers will find valuable design rules and principles of high-frequency applicators and probes for materials processing and sensing applications in this expanded edition. Presents new information on how the interactions of electromagnetic fields with materials at high frequencies have given rise to a vast array of practical applications in industry, science, medicine, and consumer markets Thoroughly revised and expanded edition, providing an update on the most recent trends and findings Contains many new sections within existing chapters, along with new chapters on applicators for plasmas at microwave/RF frequencies

This book provides the most comprehensive and in-depth coverage of the latest circuit design developments in RF CMOS technology. It is a practical and cutting-edge guide, packed with proven circuit techniques and innovative design methodologies for solving challenging problems associated with RF integrated circuits and systems. This invaluable resource features a collection of the finest design practices that may soon drive the system-on-chip revolution. Using this book’s state-of-the-art design techniques, one can apply existing technologies in novel ways and to create new circuit designs for the future.

Introduction The exponential scaling of feature sizes in semiconductor technologies has side-effects on layout optimization, related to effects such as interconnect delay, noise and crosstalk, signal integrity, parasitics effects, and power dissipation, that invalidate the assumptions that form the basis of previous design methodologies and tools. This book is intended to sample the most important, contemporary, and advanced layout optimization problems emerging with the advent of very deep submicron technologies in semiconductor processing. We hope that it will stimulate more people to perform research that leads to advances in the design and development of more efficient, effective, and elegant algorithms and design tools. Organization of the Book The Book is organized as follows. A multi-stage simulated annealing algorithm that integrates floorplanning and interconnect planning is presented in Chapter 1. To reduce the run time, different interconnect plan ring approaches are applied in different ranges of temperatures. Chapter 2 introduces a new design methodology - the interconnect-centric design methodology and its centerpiece, interconnect
planning, which consists of physical hierarchy generation, floorplanning with interconnect planning, and interconnect architecture planning. Chapter 3 investigates a net-cut minimization based placement tool, Dragon, which integrates the state of the art partitioning and placement techniques.

In late 1877, Louis Cailliette in France and Raoul Pictet in Switzerland independently succeeded in liquefying oxygen, thereby proving a hypothesis set forth by Antoine Lavoisier nearly 100 years earlier. The theme of the 1977 Cryogenic Engineering Conference "Cryogenics: A Century of Progress-At Chalmers for the Future" properly commemorated this accomplishment by reviewing some of the noteworthy advances since that time and outlining many advances still to come. Both Volumes 23 and 24 of this series provide a good account of the many contributions that were presented at that conference. The 1975 Cryogenic Engineering Conference was appropriately again held in Boulder, Colorado where the first Cryogenic Engineering Conference was initiated 23 years ago by the late Russell B. Scott, then Chief of the Cryogenic Engineering Laboratory of the National Bureau of Standards. The Cryogenic Engineering Conference Board is extremely grateful to members of the National Bureau of Standards and the University of Colorado for serving as hosts for this meeting of cryogenic specialists from all over the world. The Cryogenic Engineering Conference is again pleased to have had the International Cryogenic Materials Conference co-host this biennial meeting for the second time in succession. This joint effort again has emphasized an in-depth coverage of research on technical materials in areas currently receiving primary attention by the cryogenic engineering community. The Proceedings of the Inter national Cryogenic Materials Conference will be published as Volume 24 of the Advances in Cryogenic Engineering.

Bridges the gap between electromagnetics and circuits by addressing electromagnetic modeling (EM) using the Partial Element Equivalent Circuit (PEEC) method. This book provides intuitive solutions to electromagnetic problems by using the Partial Element Equivalent Circuit (PEEC) method. This book begins with an introduction to circuit analysis techniques, laws, and frequency and time domain analyses. The authors also treat Maxwell's equations, capacitance computations, and inductance computations through the lens of the PEEC method. Next, readers learn to build PEEC models in various forms: equivalent circuit models, non-orthogonal PEEC models, skin-effect models, PEEC models for dielectrics, incident and radiation field modeling, and scattering PEEC models. The book concludes by considering issues like stability and passivity, and includes five appendices some with formulas for partial elements. Leads readers to the solution of a multitude of practical problems in the areas of signal and power integrity and electromagnetic interference Contains fundamentals, applications, and examples, of the PEEC method. Includes detailed mathematical derivations Circuit Oriented Electromagnetic Modeling Using the PEEC Techniques is a reference for students, researchers, and developers who work on the physical layer modeling of IC interconnects and Packaging, PCBs, and high speed links.

This authoritative reference enables the design of virtually every type of inductor. It features a single simple formula for each type of inductor, together with tables containing essential numerical factors. 1944 edition. This second edition of the highly acclaimed RF Power Amplifiers has been thoroughly revised and expanded to reflect the latest challenges associated with power transistors used in communications systems. With more rigorous treatment of many concepts, the new edition includes a unique combination of class-tested methods and industry-proven design techniques. Radio frequency (RF) power amplifiers are the fundamental building blocks used in a vast variety of wireless communication circuits, radio and TV broadcasting transmitters, radars, wireless energy transfer, and industrial processes. Through a combination of theory and practice, RF Power Amplifiers, Second Edition provides a solid understanding of the key concepts, the principle of operation, synthesis, analysis, and design of RF power amplifiers. This extensive update boasts: up to date end of chapter summaries; review questions and problems; an expansion on key concepts; new examples related to real-world applications illustrating key concepts and brand new chapters covering ‘hot topics’ such as RF LC oscillators and dynamic power supplies. Carefully edited for superior readability, this work remains an essential reference for research & development staff and design engineers. Senior level undergraduate and graduate electrical engineering students will also find it an invaluable resource with its practical examples & summaries, review questions and end of chapter problems. Key features: • A fully revised solutions manual is now hosted on a companion website alongside new simulations. • Extended treatment of a broad range of topologies of RF power amplifiers. • In-depth treatment of state-of-the-art of modern transmitters and a new chapter on oscillators. • Includes problem-solving methodology, step-by-step derivations and closed-form design equations with illustrations. Concise text derives common partial differential equations, discussing and applying techniques of Fourier analysis. Also covers Legendre, Bessel, and Mathieu functions and general structure of differential operators. 1953 edition. Based on the fundamentals of electromagnetics, this clear and concise text explains basic and applied principles of transformer and inductor design for power electronic applications. It details both the theory and practice of inductors and transformers employed to filter currents, store electromagnetic energy, provide physical isolation between circuits, and perform stepping up and down of DC and AC voltages. The authors present a broad range of applications from modern power conversion systems. They provide rigorous design guidelines based on a robust methodology for inductor and transformer design. They offer real design examples, informed by proven and working field examples. Key features include: emphasis on high-frequency design, including design of the winding layout and treatment of non-sinusoidal waveforms a chapter on planar magnetic with analytical models and descriptions of the processing technologies analysis of the role of variable inductors, and their applications for power factor correction and solar power unique coverage on the measurements of inductance and transformer capacitance, as well as tests for core losses at high frequency worked examples in MATLAB, end-of-chapter problems, and an accompanying website containing solutions, a full set of instructors' presentations, and copies of all the figures. Covering the basics of the magnetic components of power electronic converters, this book is a comprehensive reference for students and professional engineers dealing with specialised inductor and transformer design. It is especially useful for senior undergraduate and graduate students in electrical engineering and electrical energy systems, and engineers working with power supplies and energy conversion systems who want to update their knowledge on a field that has progressed considerably in recent years.

A rigorous and straightforward treatment of analog, digital and optical transmission lines, which avoids using complex mathematics. This book gives a state-of-the-art overview by internationally recognized researchers of the architectures of breakthrough devices required for future intelligent integrated systems. The first section highlights Advanced Silicon-Based CMOS Technologies: New device and functional architectures are reviewed in chapters on Tunneling Field-Effect Transistors and 3-D monolithic Integration, which the alternative materials could possibly use in the future. The way we can augment silicon technologies is illustrated by the co-integration of new types of devices, such as molecular and resistive spintronics-based memories and smart sensors, using nanoscale features co-integrated with silicon CMOS or above it. As circuit boards are increasingly required to transmit signals at higher and higher speeds, signal and power integrity become increasingly crucial. Rules of thumb that you have used over and over again to prevent signal loss no longer apply to these new, high-speed, high-density circuit designs. This leading-edge circuit design resource offers you the knowledge needed to quickly pinpoint transmission problems that can compromise your entire circuit design. Discussing both design and debug issues at gigabit per second data rates, the book serves as a practical reference for your projects involving high-speed serial signaling on printed wiring boards. The only resource devoted Solely to Inductance Inductance is an unprecedented text, thoroughly discussing “loop” inductance as well as the increasingly important “partial” inductance. These concepts and their proper calculation are crucial in designing modern high-speed digital systems. World-renowned leader in electromagnetics Clayton Paul provides the knowledge and tools necessary to understand and calculate inductance. Unlike other texts, Inductance provides all the details about the derivations of the inductances of various inductors, as well as: Fills the need for practical knowledge of partial inductance, which is essential to the prediction of power rail collapse and ground bounce problems in...
high-speed digital systems Provides a needed refresher on the topics of magnetic fields Addresses a missing link: the calculation of the values of the various physical constructions of inductors—both intentional inductors and unintentional inductors—from basic electromagnetic principles and laws Features the detailed derivation of the loop and partial inductance systems using various configurations of current-carrying conductors in the present and integrated applications on high-speed digital systems and high-frequency analog systems, it is imperative that system designers develop a intimate understanding of the conceptsand methods in this book. Inductance is a much-needed textbook designed for senior and graduate-level engineering students, as well as a hands-on guide for working engineers and professionals engaged in the design of high-speed digital and high-frequency analog systems.

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 analyzing 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 must turn to time and again to design out and troubleshoot circuit signal loss and impedance problems.

A unique text on the theory and design fundamentals of inductors and transformers, updated with more coverage on the optimization of magnetic devices and many new design examples. The first edition is popular among a very broad audience of readers in many areas of engineering and science. This book covers the theory and design techniques of the major types of high-frequency power inductors and transformers for a variety of applications, including switching-mode power supplies (SMPS) and resonant dc-to-ac power inverters. It describes eddy-current phenomena (such as skin and proximity effects), high-frequency magnetic materials, core saturation, core losses, complex permeability, high-frequency winding resistance, winding power losses, optimization of winding conductors, integrated inductors and transformers, PCB inductors, self-capacitances, self-resonant frequency, core utilization factor area product method, and design techniques and procedures of power transformers. These inductors and transformers are commonly used in power converter applications. The material in this book has been class-tested over many years in the author's own course at Wright State University, which have a high enrollment of about 300 undergraduate and graduate students per term. The book presents the growing area of magnetic component research in a textbook format, covering the foundations for analyzing and designing magnetic devices specifically at high frequencies. Integrated inductors arerescribed, and the Self-capacitance of inductors and transformers examined. This new edition adds information on the optimization of magnetic components (Chapter 5). Chapter 2 has been expanded to provide coverage of core losses and complex permeability, and Chapter 9 has more in-depth coverage of self-capacitances and self-resonant frequencies of inductors. There is a more rigorous treatment of many concepts in all chapters. Updated end-of-chapter problems aid the reader's learning process, with an onlinesolutions manual available for use in the classroom. Provides physics-based descriptions and models of discrete inductors and transformers as well as integrated magneticdevices New coverage on the optimization of magnetic devices, updated information on core losses and complex permeability, and more in-depth coverage of self-capacitances and self-resonant frequency of inductors Many new design examples and end-of-chapter problems for thereader to test their learning. Presents the most up-to-date and important references in the field. Updated solutions manual, now available through a companionwebsite An up to date resource for Post-graduates and professors working in electrical and computer engineering. Research students in power electronics, circuit design, and RF (radio-frequency) power amplifiers, senior and graduate students in electrical engineering, and R & D staff.

The aim of this book is to serve as a design reference for students and as an up-to-date reference for researchers. It also acts as an excellent introduction for newcomers to the field and offers established rf/microwave engineers a comprehensive refresher. The content is roughly classified into two—the first two chapters provide the necessary fundamentals, while the last three chapters focus on design and applications. Chapter 2 covers detailed treatment of transmission lines. The Smith chart is utilized in this chapter as an important tool in the synthesis of matching networks for microwave amplifiers. Chapter 3 contains an exhaustive review of microstrip circuits, culled from various references. Chapter 4 offers practical design information on solid state amplifiers, while Chapter 5 contains topics on the design of modern planar filters, some of which were seldom published previously. A set of problems at the end of each chapter provides problems which are compiled from actual university exam questions. An extensive list of references is available at the end of each chapter to enable readers to obtain further information on the topics covered.

This book reflects Marc Thompson's twenty years of experience designing and teaching analog circuit design. He describes intuitive and "back of the envelope" techniques for designing and analyzing analog circuits, including transistor amplifiers (CMOS and bipolar), transistor switching, thermal circuit design, digital circuit design, control systems, and the like. The application of some simple rules-of-thumb and design techniques is the first step in developing an intuitive understanding of the behavior of complex electrical systems. This book outlines some ways of thinking about analog circuits and systems that hopefully develops such "circuit intuition" and a "feel for what a good, working analog circuit design should be." Introduces analog circuit design with a minimum of mathematics. "Gives readers an intuitive "feel" for analog circuit operation and rules-of-thumb for their design." Uses numerous analogies from digital design to help readers whose main background is in digital make the transition to analog design. *Accompanying CD-ROM contains PowerPoint presentations for each chapter and MATLAB files used in the text.

This book describes a new concept for analyzing RF/microwave circuits, which includes RF/microwave antennas. The book is unique in its emphasis on practical and innovative microwave RF engineering applications. The analysis is based on nonlinear dynamic models and chaos models and shows comprehensive benefits and results. All conceptual RF microwave circuits and antennas are innovative and can be broadly implemented in engineering applications. Given the dynamics of RF microwave circuits and antennas, they are suitable for use in a broad range of applications. The book presents analytical methods for microwave RF antennas and circuit analysis, concrete examples, and geometric examples. The analysis is developed systematically, starting with basic differential equations and their bifurcations, and subsequently moving on to fixed point analysis, limit cycles and their bifurcations. Engineering applications include microwave RF circuits and antennas in a variety of topological structures, RFID ICs and antennas, microstrip, circulators, cylindrical RF network antennas, Tunnel Diodes (TDs), bipolar transistors, field effect transistors (FETs), IMPATT amplifiers, Small Signal (SS) amplifiers, Bias-T circuits, PIN diode circuits, power amplifiers, oscillators, resonators, filters, N-turn antennas, dual spiral coil antennas, helix antennas, linear dipole and slot arrays, and hybrid linear and nonlinear circuits. In each chapter, the concept is developed from the basic assumptions up to the final engineering outcomes. The scientific background is explained at basic and advanced levels and closely integrated with mathematical theory. The book also includes a wealth of examples, making it ideal for intermediate graduate level studies. It is aimed at electrical and electronic engineers, RF and microwave engineers, students and researchers in physics, and will also greatly benefit all engineers who have had no formal instruction in nonlinear dynamics, but who now desire to bridge the gap between innovative microwave RF circuits and antennas and advanced mathematical analysis methods.

This practical book is the first comprehensive treatment of lumped elements, which are playing a critical role in the development of the circuits that make these cost-effective systems possible. The book offers professionals an in-depth understanding of the different types of RF and microwave circuit elements.

Interactions of electromagnetic fields with materials at high frequencies have given rise to a vast array of practical applications in industry, science,
medicine, and consumer markets. Applicators or probes, which are the front end of these systems, provide the field that interacts with the material. This book takes an integrated approach to the area of high frequency applicators and probes for material interactions, providing a toolkit for those who design these devices. Particular attention is given to real-world applications and the latest developments in this area. Mathematical modeling methods are particularly highlighted, as are design tools and methods developed by hand calculators. Useful equations and numerically solved examples, using situations encountered in practice, are supplied. Above all, this volume is a comprehensive and useful reference where the reader can find design rules and principles of high frequency applicators and probes for material processing and sensing applications. Electronic and electrical R&D engineers, physicists, university professors and students will all find this book a valuable reference. Mehrdad Mehdizadeh is with the DuPont Company, Engineering Research & Technology Division in Wilmington, Delaware. His areas of expertise include high frequency and electromagnetic methods of processing, sensing, and characterization of materials. His work and innovation in industrial, scientific, and medical applications of radio frequency and microwaves has resulted in 19 US patents and a number of publications. He earned his Ph.D. and M.S. from Marquette University (1983, 1980), and a B.S. from Sharif University of Technology (1977), all in electrical engineering. Dr. Mehdizadeh is a Senior Member of the Institute of Electrical and Electronic Engineers (IEEE), Sigma Xi (Scientific Research Society of America), the International Microwave Power Institute, a member of IEEE Standards Association and a voting member of the IEEE Standards Board. His areas of expertise are usually theoretical; this book provides practical guidance for those who actually intend to design a system. Features real world and numerically solved examples, and curve-fitted simple equations to replace complex equations provided in typical texts • Author is a voting member of IEEE Standards Association.

Provides a detailed and systematic description of the Methods of Moments (Boundary Element Method) for electromagnetic modeling at low frequency and includes hands-on, application-based MATLAB® modules with user-friendly and intuitive GUI and a highly visualized interactive output. Includes a full-body computational human phantom with over 120 triangular surface meshes extracted from the Visible Human Project® Female dataset of the National library of Medicine and fully compatible with MATLAB® and major commercial FEM/BEM- electromagnetic software simulators. This book covers the basic concepts of computational low-frequency electromagneticics in an application of boundary element method, providing a basic knowledge of the concepts with hands-on MATLAB® modules. The book is divided into five parts. Part 1 discusses low-frequency electromagneticics, basic theory of triangular surface mesh modeling, and computational human phantoms. Part 2 covers electrostatics of conductors and dielectrics, and direct current flow. Linear magnetostatics is analyzed in Part 3. Part 4 examines theory and applications of eddy current, and magnetic field in a conductor and dielectric with its applications included in this book. Part 5 is devoted to applications. This book is focused on the development of a method to solve the problem of electromagnetic field in a thin plate, which will be a basic element to build a computer model of the electromagnetic field in a thin plate, and it includes four chapters. Each chapter concludes with a summary of the corresponding MATLAB® modules. Combines fundamental electromagnetic theory and application-oriented simulation algorithms in the form of stand alone MATLAB® modules. Makes use of the three-dimensional Method of Moments (MoM) for static and quasistatic electromagnetic problems. Contains a detailed full-body computational human phantom from the Visible Human Project® Female, embedded implant models, and a collection of homogeneous human shells. Low-Frequency Electromagnetic Modeling for Electrical and Biological Systems Using MATLAB® is a resource for electrical and biomedical engineering students and practicing researchers, engineers, and medical doctors working on low-frequency modeling and bioelectromagnetic applications.

The only book on the market that emphasizes machine design beyond the basic principles of AC and DC machine behavior AC electrical machine design is a key skill set for developing competitive electric motors and generators for applications in industry, aerospace, and defense. This book presents a thorough treatment of AC machine design, starting from basic electromagnetic principles and continuing through the various design aspects of an induction machine. Introduction to AC Machine Design includes one chapter each on the design of permanent magnet machines, synchronous machines, and thermal management of the use of finite elements to model the magnetic field in a machine without interfering with the initial comprehension of the core subject matter. Based on the author’s notes, as well as after years of classroom instruction, Introduction to AC Machine Design: Brings to light more advanced principles of machine design—not just the basic principles of AC and DC machine behavior Introduces electrical machine design to neophytes while also being a resource for experienced designers Fully examines AC machine design, beginning with basic electromagnetic principles Covers the many facets of the induction machine design Introduction to AC Machine Design is an important text for graduate school students studying the design of electrical machinery, and it will be of great interest to manufacturers of electrical machinery.

Despite the powerful numerical techniques and graphical user interfaces available in present software tools for power system transients, a lack of reliable tests and conversion procedures generally makes determination of parameters the most challenging part of creating a model. Illustrates Parameter Determination for Real-World Applications Geared toward both students and professionals with at least some basic knowledge of electromagnetic transient analysis, Power System Transients: Parameter Determination summarizes current procedures and techniques for the determination of transient parameters for six basic power components: overhead line, insulated cable, transformer, synchronous machine, surge arrestor, and circuit breaker. An expansion on papers published in the IEEE Transactions on Power Delivery, this text helps those using transient simulation tools (e.g., EMTP-like tools) to select the optimal determination method for their particular model, and it addresses commonly encountered problems, including: Lack of information Testing setups and measurements that are not recognized in international standards Insufficient studies to validate models, mainly those used in high-frequency transients Current built-in models that do not cover all requirements Illustrated with case studies, this book provides modeling selection of adequate representations for main components. It discusses how to collect the information needed to obtain model parameters and also reviews procedures for deriving them. Appendices summarize updated techniques for identifying linear systems from frequency responses and review capabilities and limitations of simulation tools. Emphasizing standards, this book is a clear and concise presentation of key aspects in creating an adequate and reliable transient model.

This book presents inductive and hybrid levitation micro-systems and their applications in micro-sensors and -actuators. It proposes and discusses analytical and quasi-finite element techniques for modeling levitation micro-systems based on the Lagrangian formalism. In particular, micro-beam, -actuators, -accelerators and -accelerometers based on inductive levitation are comprehensively described with accompanying experimental measurements.

Proper design of printed circuit boards can make the difference between a product passing emissions requirements during the first cycle or not. Traditional EMC design practices have been simply rule-based, that is, a list of rules-of-thumb are presented to the board designers to implement. When a particular rule-of-thumb is difficult to implement, it is often ignored. After the product is built, it will often fail emission requirements and various time consuming and costly add-ons are then required. Proper EMC design does not require advanced degrees from universities, nor does it require strenuous mathematics. It does require a basic understanding of the underlying principles of the potential causes of EMC emissions. With this basic understanding, circuit board designers can make trade-off decisions during the design phase to ensure optimum EMC design.
Consideration of these potential sources will allow the design to pass the emissions requirements the first time in the test laboratory. A number of other books have been published on EMC. Most are general books on EMC and do not focus on printed circuit board is intended to help EMC engineers and design design. This book engineers understand the potential sources of emissions and how to reduce, control, or eliminate these sources. This book is intended to be a ‘hands-on’ book, that is, designers should be able to apply the concepts in this book directly to their designs in the real-world.

Analog Circuit Design is based on the yearly Advances in Analog Circuit Design workshop. The aim of the workshop is to bring together designers of advanced analogue and RF circuits for the purpose of studying and discussing new possibilities and future developments in this field. Selected topics for AADC 2007 were: (1) Sensors, Actuators and Power Drivers for the Automotive and Industrial Environment; (2) Integrated PA’s from Wireline to RF; (3) Very High Frequency Front Ends.

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