Microstrip Antennas The Analysis And Design Of Arrays

This book focuses on recent advances in the field of microstrip antenna design and its applications in various fields including space communication, mobile communication, wireless communication, medical implants and wearable applications. Scholars as well as researchers and those in the electronics/electrical/instrumentation engineering fields will benefit from this book. The book shall provide the necessary literature and techniques using which to assist students and researchers would design antennas for the above-mentioned applications and will ultimately enable users to take measurements in different environments. It is intended to help scholars and researchers in their studies, by enhancing their knowledge and skills in on the latest applications of microstrip antennas in the world of communications such as world like IoT, D2D, satellites and wearable devices, to name a few. FEATURES Addresses the complete functional framework workflow in printed antenna design systems Explores the basic and high-level concepts, including advanced aspects in planer design issues, thus serving as a manual for those in the industry while also assisting beginners Provides the latest techniques used for antennas in terms of structure, defected ground, MIMO and fractal designs Discusses case studies related to data-intensive technologies in microchip antennas in terms of the most recent applications and similar uses for the Internet of Things and device-to-device communication This exciting new book focuses on the analysis and design of reconfigurable antennas for modern wireless communications, sensing, and radar. It presents the definitions of basic antenna parameters, an overview of RF switches and explains how to characterize their insertion loss, isolation, and power handling issues. Basic reconfigurable antenna building blocks, such as dipoles, monopoles, patches and slots are described, followed by presentations on frequency reconfigurable antennas, pattern reconfigurable antennas, and basic scanning antenna arrays. Switch biasing in an electromagnetic environment is discussed, as well as simulation strategies of reconfigurable antennas, and MIMO (Multiple Input Multiple Output) reconfigurable antennas. Performance characterization of reconfigurable antennas is also presented. The book provides information for the technical professional to design frequency reconfigurable, pattern reconfigurable, and MIMO antennas all relevant for modern wireless communication systems. Readers learn how to select switching devices, bias them properly, and understand their role in the overall reconfigurable antenna design. The book presents practical experimental implementation issues, including losses due to switches, materials, and EMI (Electromagnetic Interference) and shows how to address those.

An array antenna is an assembly of radiating elements in one of many possible geometrical configurations with outputs of the individual elements in the array combined to produce radiation of desired pattern shape and gain. The advantages of array antennas over a single antenna include the following: 1) high gain and high resolution without increasing the physical size of each element, 2) electronic control of radiation patterns, such as scanning of main beam and shaping of radiation pattern, and 3) graceful degradation. Many techniques have been developed in the synthesis of array patterns. Most of the techniques, however, ignore mutual coupling between array elements. Mutual coupling is the electromagnetic interaction between array elements. In addition, unless the antenna elements are perfectly isolation power dividers are used, there will be coupling through the feed network. The two fold coupling problem (element-to-element and feed network coupling) then becomes difficult for analysis and very difficult for synthesis. This is because coupling from one element to another can travel through the feed network and reappear in other elements leading to further antenna coupling: this is an endless coupling effect. (RH).
The Most Complete, Up-to-Date Coverage of the Finite Element Analysis and Modeling of Antennas and Arrays Aimed at researchers as well as practical engineers—and packed with over 200 illustrations including twenty-two color plates—Finite Element Analysis of Antennas and Arrays presents: Time- and frequency-domain formulations and mesh truncation techniques Antenna source modeling and parameter calculation Modeling of complex materials and fine geometrical details Analysis and modeling of narrowband and broadband antennas Analysis and modeling of infinite and finite phased-array antennas Analysis and modeling of antenna and platform interactions Recognizing the strengths of other numerical methods, this book goes beyond the finite element method and covers hybrid techniques that combine the finite element method with the finite difference time-domain method, the method of moments, and the high-frequency asymptotic methods to efficiently deal with a variety of complex antenna problems. Complemented with numerous examples, this cutting-edge resource fully demonstrates the power and capabilities of the finite element analysis and its many practical applications.

Engineers do not have the time to wade through rigorously theoretical books when trying to solve a problem. Beginners lack the expertise required to understand highly specialized treatments of individual topics. This is especially problematic for a field as broad as electromagnetics, which propagates into many diverse engineering fields. The time h

The book reviews developments in the following fields: circular microstrip antennas; microstrip patch antennas; circular polarisation and bandwidth; microstrip dipoles; multilayer and parasitic configurations; wideband flat dipole and short-circuit microstrip patch elements and arrays; numerical analysis; multiport network approach; transmission-line model; rectangular microstrip antennas; low-cost printed antennas; printed phased-array antennas; circularly polarised antenna arrays; microstrip antenna feeds; substrate technology; computer-aided design of microstrip and triplate circuits; resonant microstrip antenna elements and arrays for aerospace applications; mobile and satellite systems; conical conformal microstrip tracking antenna; and microstrip field diagnostics.

Small planar antennas are becoming increasingly popular in personal wireless communication systems since these antennas offer advantages such as small size, light weight, robust construction, ease of integration into mobile handsets, reasonable radiation efficiency and gain. A new small microstrip antenna operating at 880MHz is designed using the Finite difference time domain technique incorporating the perfectly matched-layer formulation. Shorting pins are used to achieve the reduction in size. The size of this patch antenna is approximately four times less than that of the regular half wavelength patch antenna. An antenna array made of the new patch antennas is used in a multiple antenna system to reliably separate different users on the same channel using linearbeam steering techniques with the ultimate goal of increasing the channel capacity. Prototypes of the proposed dual shorted-pin-patch antenna are fabricated and measurements of their return loss compare well with the computational results.

JPL spacecraft antennas—from the first Explorer satellite in 1958 to current R & D Spaceborne Antennas for Planetary Exploration covers the development of Jet Propulsion Laboratory (JPL) spacecraft antennas, beginning with the first Explorer satellite in 1958 through current research and development activities aimed at future missions. Readers follow the evolution of all the new designs and technological innovations that were developed to meet the growing demands of deep space exploration. The book focuses on the radio frequency design and performance of antennas, but covers environmental and mechanical considerations as well. There
is additionally a thorough treatment of all the analytical and measurement techniques used in design and performance assessment. Each chapter is written by one or more leading experts in the field of antenna technology. The presentation of the history and technology of spaceborne antennas is aided by several features: * Photographs and drawings of JPL spacecraft * Illustrations to help readers visualize concepts and designs * Tables highlighting and comparing the performance of the antennas * Bibliographies at the end of each chapter leading to a variety of primary and secondary source material This book complements Large Antennas of the Deep Space Network (Wiley 2002), which surveys the ground antennas covered in support of spacecraft. Together, these two books completely cover all JPL antenna technology, in keeping with the JPL Deep Space Communications and Navigation Series mission to capture and present the many innovations in deep space telecommunications over the past decades. This book is a fascinating and informative read for all individuals working in or interested in deep space telecommunications.

Annotation Microstrip antennas are lightweight and small volume, can be made conformal to the host surface, and are manufactured using printed-circuit technology so can be mass produced at low cost, but alas, say Kumar and Ray (Indian Institute of Technology, Bombay) their use has been restricted by their inherently narrow bandwidth. Over the past few decades, however, reports have surfaced of broadband configurations, and they detail the most promising, compiling material from scattered journals, conference proceedings, and books. They explain concepts of several techniques, and describe examples without bogging down in mathematical detail. Annotation copyrighted by Book News, Inc., Portland, OR.

Volume II of Theoretical Studies of Microstrip Antennas deals with the analysis and synthesis of several types of novel multi-resonant elements with emphasis on dual-frequency operation of rectangular microstrip patch antennas with or without external matching networks. Specifically, we analyze dual resonances created within a single rectangular patch by means of appropriate dielectric loading and also those associated with a patch capacitively-coupled to either a lumped or distributed matching network. In all cases radiation is obtained from slots in the rectangular patch in combination with open-circuited edges. Rather than separately design the dual-resonating elements and matching networks and hope for efficient radiation and proper patterns at both frequencies, we favor and herein pursue an integrated synthesis which demands simultaneous fulfillment of the design goals. A synthesis approach, based upon coupled resonator theory, is also developed and applied to situations in which one resonant element is a rectangular microstrip patch and the second element either a second patch or else a lumped or distributed matching network. Based upon these considerations, several new antenna configurations are proposed that utilize either in line or stacked element geometries. Volume I of this report deals with general design techniques and analyses of single and coupled microstrip radiating elements. (Author).

This thesis provides several designs of broadband microstrip antennas for the use in WLAN applications. It also highlights the novel reconfigurable microstrip antenna design. The main objective of this thesis is to design a novel microstrip antenna that is broadband, circularly polarized, multiband, reconfigurable and easy-to-fabricate. The thesis, in the first stage, presents a review of
various different options available when designing and manufacturing wideband microstrip antennas. The review includes basic theory of microstrip patch antennas, matching techniques and broadbanding techniques. The second stage concentrates on the development of a couple of working prototype antenna designs and finally presents the design of a reconfigurable antenna that can perform over several frequency bands. The shapes of broadband patch antennas used are rectangular, circular and triangular. The multiple resonance technique is used in the design of the broadband antennas. Numerical and measured results are presented and discussed. The proposed patch antennas give measured bandwidth up to 28.5%. The reconfigurable antenna on the other hand is designed to possess frequency and polarization reconfigurability, and can operate in six different frequency bands. In addition to the bandwidth advantage, the proposed configuration offers easy reconfigurability with the ability to exclude switches in the combination part of the feed network. The important aspect of this design is that it provides a high size reduction for all the operating frequencies compared to conventional rectangular patches. Besides compactness all proposed antennas have gain better than 7dB. The proposed antennas are found to be suitable for WLAN standards.

Electromagnetics is too important in too many fields for knowledge to be gathered on the fly. A deep understanding gained through structured presentation of concepts and practical problem solving is the best way to approach this important subject. Fundamentals of Engineering Electromagnetics provides such an understanding, distilling the most important theoretical aspects and applying this knowledge to the formulation and solution of real engineering problems. Comprising chapters drawn from the critically acclaimed Handbook of Engineering Electromagnetics, this book supplies a focused treatment that is ideal for specialists in areas such as medicine, communications, and remote sensing who have a need to understand and apply electromagnetic principles, but who are unfamiliar with the field. Here is what the critics have to say about the original work "...accompanied with practical engineering applications and useful illustrations, as well as a good selection of references ... those chapters that are devoted to areas that I am less familiar with, but currently have a need to address, have certainly been valuable to me. This book will therefore provide a useful resource for many engineers working in applied electromagnetics, particularly those in the early stages of their careers." -Alastair R. Ruddle, The IEE Online "...a tour of practical electromagnetics written by industry experts ... provides an excellent tour of the practical side of electromagnetics ... a useful reference for a wide range of electromagnetics problems ... a very useful and well-written compendium..." -Alfy Riddle, IEEE Microwave Magazine Fundamentals of Engineering Electromagnetics lays the theoretical foundation for solving new and complex engineering problems involving electromagnetics. "This anthology combines 15 years of microstrip antenna technology research into one significant volume and includes a special introductory tutorial by the co-editors. Covering theory, design and modeling techniques and methods, this source book is an excellent reference tool for engineers who want to become more familiar with microstrip antennas and microwave systems. Proven antenna designs, novel solutions to practical design problems and relevant papers describing the theory of operation and analysis of microstrip antennas are contained within this convenient reference." The discipline of antenna theory has experienced vast technological changes. In response, Constantine Balanis has updated his
classic text, Antenna Theory, offering the most recent look at all the necessary topics. New material includes smart antennas and fractal antennas, along with the latest applications in wireless communications. Multimedia material on an accompanying CD presents PowerPoint viewgraphs of lecture notes, interactive review questions, Java animations and applets, and MATLAB features. Like the previous editions, Antenna Theory, Third Edition meets the needs of electrical engineering and physics students at the senior undergraduate and beginning graduate levels, and those of practicing engineers as well. It is a benchmark text for mastering the latest theory in the subject, and for better understanding the technological applications. An Instructor's Manual presenting detailed solutions to all the problems in the book is available from the Wiley editorial department.

Based on Bahl and Bhartia's popular 1980 classic, Microstrip Antennas, this all new book provides the detail antenna engineers and designers need to design any type of microstrip antenna. After addressing essential microchip antenna theory, the authors highlight current design and engineering practices, emphasizing the most pressing issues in this area, including broadbanding, circular polarization, and active microstrip antennas in particular. Special design challenges, ranging from dual polarization, high bandwidth, and surface wave mitigation, to choosing the proper substrate, and shaping an antenna to achieve desired results are all covered.

A one-stop reference to the design and analysis of nonplanar microstrip structures. Owing to their conformal capability, nonplanar microstrip antennas and transmission lines have been intensely investigated over the past decade. Yet most of the accumulated research has been too scattered across the literature to be useful to scientists and engineers working on these curved structures. Now, antenna expert Kin-Lu Wong compiles and organizes the latest research results and other cutting-edge developments into an extensive survey of the characteristics of microstrip antennas mounted on canonical nonplanar surfaces. Demonstrating a variety of theoretical techniques and deducing the general characteristics of nonplanar microstrip antennas from calculated results, Wong thoroughly addresses the problems of cylindrical, spherical, and conical structures and gives readers powerful design and optimization tools. Up-to-date topics range from specific applications of spherical and conical microstrip arrays to the curvature effects on the analysis of cylindrical microstrip lines and coplanar waveguides. With 256 illustrations and an exhaustive list of references, Design of Nonplanar Microstrip Antennas and Transmission Lines is an indispensable guide for antenna designers in wireless and personal communications and in radar systems, and an invaluable reference for researchers and students interested in this important technology.

In the past few years, the concept of creating microwave antennas using microstrip has attracted increasing attention and viable practical designs are now emerging. The purpose of this monograph is to present the reader with an appreciation of the underlying physical action, up-to-date theoretical treatments, useful antenna design approaches and the overall state-of-the-art situation. The emphasis is on antenna engineering design, but to achieve this goal it has been necessary to delve into the behaviour of microstrip in a much wider sense and also include aspects of electromagnetic analysis. As a consequence, the monograph will also be of interest to microstrip circuit designers and to some extent those seeking electromagnetic problems of a challenging
nature. The astronomical progress in miniaturising and integrating electronic circuits in the past decade has recently crerated a positive demand for a new generation of antenna systems. In principle, microstrip antennas are thin planar configurations that are lightweight, low cost, easy to manufacture and can be made conformal with the surfaces of vehicles, missiles etc. The compatibility of microstrip antennas with integrated electronics is another great advantage. However, the microstrip wavetrapping effects inhibit the radiation mechanism and must be taken into account in antenna design. Wave-trapping effects in substrates involve the study of surface waves and discontinuities in open waveguide structures. The microstrip antenna designer must therefore encompass many more effects than previously considered by microstrip circuit designers. It is for these reasons that the scope of this monograph is necessarily somewhat wider than the title may suggest. The ten chapters are a blend of introductory, practical and theoretical treatments and likely future developments are also highlighted. A good selection of past and current references are given and each chapter concludes with a helpful summary comment.

A new feed configuration for microstrip antennas is analyzed. The antenna consists of a single rectangular microstrip patch coupled through a rectangular aperture to a microstrip line on a separate substrate. The report describes the theory which uses a moment method analysis to calculate the antenna's input impedance. The analysis was verified by comparison with measurements of patch antennas on a low-dielectric-constant substrate (2.54) and the Feed line on high-dielectric-constant (10.2) substrate. (Author).

This comprehensive resource presents antenna fundamentals balanced with the design of printed antennas. Over 70 antenna projects, along with design dimensions, design flows and antenna performance results are discussed, including antennas for wireless communication, 5G antennas and beamforming. Examples of smartphone antennas, MIMO antennas, aerospace and satellite remote sensing array antennas, automotive antennas and radar systems and many more printed antennas for various applications are also included. These projects include design dimensions and parameters that incorporate the various techniques used by industries and academia.

This thoroughly updated third edition of this popular book covers all types of printed microstrip antenna design, from rectangular to circular, broadband and dual band, and millimeter wave microstrip antenna to microstrip arrays. The book features new analysis of rectangular and circular microstrip antenna efficiency, and surface wave phenomena. Rectangular microstrip antenna cross polarization analysis and mitigation is expanded upon. Microstrip antenna array geometry options have been added to the text. The design of Vivaldi antennas has been revised and updated based on recent analysis. A chapter has been added which addresses design considerations for millimeter wave microstrip antennas and arrays. Sections addressing the design of shorted annular, patch-ring, corporate fed OMA, stripline series slot, inverted F, RFID Loop Coupler, CPW monopole, and characteristic mode antennas have been added. The appendices have been enlarged, and address PIM, efficiency computation, twin strip and parallel plate transmission line, the history of the decibel, return loss and reflection loss, new impedance matching methods, as well as a new appendix on baluns for printed antennas. Written with commercial applications in mind and aimed at practicing
engineers, this book covers printed antennas and their design from the perspective of a seasoned consulting engineer who has worked many years in the field and has implemented all design concepts and technologies featured in the book and is essential reading for antenna designers and engineers.

Antenna Theory and Microstrip Antennas offers a uniquely balanced analysis of antenna fundamentals and microstrip antennas. Concise and readable, it provides theoretical background, application materials, and details of recent progress. Exploring several effective design approaches, this book covers a wide scope, making it an ideal hands-on resource for professionals seeking a refresher in the fundamentals. It also provides the basic grounding in antenna essentials that is required for those new to the field. The book’s primary focus is on introducing practical techniques that will enable users to make optimal use of powerful commercial software packages and computational electromagnetics used in full wave analysis and antenna design. Going beyond particular numerical computations to teach broader concepts, the author systematically presents the all-important spectral domain approach to analyzing microstrip structures including antennas. In addition to a discussion of near-field measurement and the high-frequency method, this book also covers: Elementary linear sources, including Huygen’s planar element, and analysis and synthesis of the discrete and continuous arrays formed by these elementary sources The digital beam-forming antenna and smart antenna Cavity mode theory and related issues, including the design of irregularly shaped patches and the analysis of mutual coupling Based on much of the author’s own internationally published research, and honed by his years of teaching experience, this text is designed to bring students, engineers, and technicians up to speed as efficiently as possible. This text purposefully emphasizes principles and includes carefully selected sample problems to ease the process of understanding the often intimidating area of antenna technology. Paying close attention to this text, you will be able to confidently emulate the author’s own systematic approach to make the most of commercial software and find the creative solutions that every job seems to require. This book focuses on performance enhancement of printed antennas using frequency selective surfaces (FSS) technology. The growing demand of stealth technology in strategic areas requires high-performance low-RCS (radar cross section) antennas. Such requirements may be accomplished by incorporating FSS into the antenna structure either in its ground plane or as the superstrate, due to the filter characteristics of FSS structure. In view of this, a novel approach based on FSS technology is presented in this book to enhance the performance of printed antennas including out-of-band structural RCS reduction. In this endeavor, the EM design of microstrip patch antennas (MPA) loaded with FSS-based (i) high impedance surface (HIS) ground plane, and (ii) the superstrates are discussed in detail. The EM analysis of proposed FSS-based antenna structures have been carried out using transmission line analogy, in combination with the reciprocity theorem. Further, various types of novel FSS structures are considered in designing the HIS ground plane and superstrate for enhancing the MPA bandwidth and directivity. The EM design and performance analyses of FSS-based antennas are explained here with the appropriate expressions and illustrations.