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Printed MIMO Antenna Engineering MIMO Antennas for Wireless Communication Multifunctional MIMO Antennas: Fundamentals and Application
Multifunctional MIMO Antennas Novel Millimetre Wave Antennas for MIMO and 5G Applications MIMO Antennas for Wireless Communication [Wideband, Multiband, and Smart Antenna Systems](#) Antenna Engineering Handbook [Multifunctional Ultrawideband Antennas](#) Antenna Design for Mobile Devices
MIMO Communication for Cellular Networks MIMO System Technology for Wireless Communications Next-Generation Antennas Planar Antennas MIMO
Wireless Communications Advanced Antenna Systems for 5G Network Deployments [Microstrip Antenna Design for Wireless Applications](#) Antennas
Innovation in Wearable and Flexible Antennas Fundamentals of MIMO Wireless Communications Smart Antennas Millimetre Wave Antennas for
Gigabit Wireless Communications Antennas Proceedings of Integrated Intelligence Enable Networks and Computing Advances in Antenna, Signal
Processing, and Microelectronics Engineering Microstrip and Printed Antennas: Applications-Based Designs Band-Notch Characteristics in Ultra-
Wideband Antennas Printed Antennas for Wireless Communications [Wireless Communications over MIMO Channels](#) Characteristic Modes Printed
Antennas Systems Engineering of Phased Arrays Smart Antennas Parasitic Antenna Arrays for Wireless MIMO Systems [Antennas and Propagation for
5G and Beyond](#) [Fundamentals of Wireless Communication](#) Antenna Engineering Handbook, Fourth Edition Advanced Antenna Array Engineering for 6G
and Beyond Wireless Communications Applications of Artificial Intelligence Techniques in Engineering MIMO Wireless Communications

Planar Antennas Sep 17 2021 This comprehensive reference text discusses fundamental concepts, applications, design techniques, and challenges in the field of planar antennas. The text focuses on recent advances in the field of planar antenna design and their applications in various fields of research, including space communication, mobile communication, wireless communication, and wearable applications. This resource presents planar antenna design concepts, methods, and techniques to enhance the performance parameters and applications for IoTs and device-to-device communication. The latest techniques used in antenna design, including their structures defected ground, MIMO, and fractal design, are discussed comprehensively. The text will be useful for senior undergraduate students, graduate students, and academic researchers in fields including electrical engineering, electronics, and communication engineering.

Band-Notch Characteristics in Ultra-Wideband Antennas Aug 05 2020 This book comprehensively reviews ultra-wideband (UWB) and UWB multi-input multi-output (MIMO) antennas with band-notched characteristics, with a focus on interference cancellation functionality. The book is organized into seven chapters that cover single band, dual band, and multi band-notched UWB antennas, followed by band-notched characteristics in UWB (MIMO) antennas. Further, it explains the mechanism of reconfigurability and tunability in band-notched UWB antennas, including advanced applications of UWB systems. Overall, it covers different techniques of canceling the electromagnetic interference in UWB in a concise volume. Features Provides a comprehensive presentation of avoiding interference in UWB systems Reviews state of the art literature related to UWB antennas, filtennas, and various reconfigurable technologies Explains different techniques for producing band-notch characteristics in UWB systems Includes discussion on historical perspectives of UWB technology Consolidates different research activities carried out on the electromagnetic interference cancellation techniques in the UWB communication systems Band-Notch Characteristics in Ultra-Wideband Antennas is aimed at researchers and graduate students in electrical and antenna engineering. Taimoor Khan has been an Assistant Professor at the Department of Electronics and Communication Engineering, National Institute of Technology Silchar since 2014. In addition to this, Dr. Khan has also worked as a Visiting Assistant Professor at Asian Institute of Technology Bangkok, Thailand during September–December, 2016. His active research interests include Printed Microwave Circuits, Electromagnetic Bandgap Structures, Ultra-wideband Antennas, Dielectric Resonator Antennas, Ambient Microwave Energy Harvesting, and Artificial Intelligence Paradigms in Electromagnetics. Dr. Khan has successfully guided three Ph.D. theses, and is supervising six Ph.D. students. He has published over 75 research articles in well-indexed journals and in world-renowned conference proceedings. Currently, he is executing three funded research projects, including two international collaborative SPARC and VAJRA research projects. In September 2020, Dr. Khan has been awarded a prestigious national IETE-Prof SVC Alaya Memorial Award for the year 2020. Yahia M. M. Antar has been a Professor at the Department of Electrical and Computer Engineering, Royal Military College of Canada since 1990. He served as the Chair of CNC, URSI from 1999 to 2008, Commission B from 1993 to 1999, and has a cross appointment at Queen's University in Kingston. He has authored and co-authored over 250 journal papers, several books and chapters in books, over 500 refereed conference papers, holds several patents, has chaired several national and international conferences, and has given plenary talks at many conferences. Dr. Antar is a fellow of the Engineering Institute of Canada, the Electromagnetic Academy, and an International Union of Radio Science (URSI). He was elected by the URSI to the Board as the Vice President in 2008 and in 2014, and to the IEEE AP AdCom in 2009. In 2011, he was appointed as a member of the Canadian Defence Advisory Board (DAB) of the Canadian Department of National Defence. He serves as an Associate Editor for many IEEE and IET Journals, and as an IEEE-APS Distinguished Lecturer. Presently, he is working as President-Elect for IEEE Antenna and Propagation Society for the year 2020.

Parasitic Antenna Arrays for Wireless MIMO Systems Dec 29 2019 This book unites two different technologies: parasitic antenna arrays driven via analogue circuits that control the electromagnetic waves generated by the antenna array; and MIMO technology for multi-antenna arrays, typically driven by digital techniques in the baseband domain. The combination of these two technologies has revealed a novel functionality that breaks through the conventional MIMO paradigm, allowing MIMO transmission over the air with the use of antenna arrays that may consist of only a single active element, that is surrounded by a number of passive neighboring antennas. The contributions in the book show the capability of such systems to also perform MIMO transmission. This fact holds the potential of revolutionizing the way small-form wireless terminals operate and seems to set the scene for a win-win situation, achieving MIMO transmission with very small and cheap antenna arrays. The book is structured to provide a well-rounded treatment of the various facets of this newly discovered wireless communication capability. All relevant technical angles, ranging from information theoretic to electromagnetic considerations; from analogue circuit to digital baseband control for signal generation; and from channel modeling to communication theoretic aspects are taken into account. A good balance between theory, practical considerations and over-the-air experimentation is proposed and reflected in the chapter outline. Finally, a discussion and early evidence related to potential applications as well as the relevance to current and upcoming wireless standards is provided.

Wideband, Multiband, and Smart Antenna Systems Apr 24 2022 This book provides current R&D trends and novel approaches in design and analysis of broadband, multiband, and smart antennas for 5G and B5G mobile and wireless applications, as well as the identification of integration techniques of these antennas in a diverse range of devices. The book presents theoretical and experimental approaches to help the reader in understanding the unique design issues and more advanced research. Moreover, the book includes chapters on the fundamentals of antenna theory. The book is pertinent to professionals and researchers working in the field of antenna engineering: it is written for graduate students, researchers, academics, and industry practitioners who want to improve their understanding in the current research trends in design analysis of broadband, multiband, and smart antennas for wireless applications.

Printed Antennas Mar 31 2020 Printed antennas have become an integral part of next-generation wireless communications and have been found to be commonly used to improve system capacity, data rate, reliability, etc. This book covers theory, design techniques, and the chronological regression of the printed antennas for various applications. This book will provide readers with the basic conceptual knowledge about antennas along with advanced techniques for antenna design. It covers a variety of analytical techniques and their CAD applications and discusses new applications of printed antenna technology such as sensing. The authors also present special reconfigurable antennas such as ME dipole, polarization, feeding, and DGS. The book will be useful to students as an introduction to design and applications of antennas. Additionally, experienced researchers in this field will find this book a ready reference and benefit from the techniques of research in printed antennas included in this book. Following are some of the salient features of this book: Covers a variety of analytical techniques and their CAD applications Discusses new applications of printed antenna technology such as sensing Examines the state of design techniques of printed antenna Presents special reconfigurable antennas such as ME dipole, polarization, feeding, and DGS

Systems Engineering of Phased Arrays Feb 29 2020 Phased arrays, while traditionally used in radar systems, are now being used or proposed for use in internet of things (IoT) networks, high-speed back haul communication, terabit-per-second satellite systems, 5G mobile networks, and mobile phones. This book considers systems engineering of phased arrays and addresses not only radar, but also these modern applications. It presents a system-level perspective and approach that is essential for the successful development of modern phased arrays. Using practical examples, this book helps solve problems often encountered by technical professionals. Thermal management challenges, antenna element design issues, and architectures solutions are explored as well as the benefits and challenges of digital beam forming. This book provides the information required to train engineers to design and develop phased arrays and contains questions at the end of each chapter that professors will find useful for instruction.

Antennas and Propagation for 5G and Beyond Nov 27 2019 Transforming the way we live, work, and engage with our environment, 5G and beyond technologies will provide much higher bandwidth and connectivity to billions of devices. This brings enormous opportunities but of course

the widespread deployment of these technologies faces challenges, including the need for reliable connectivity, a diverse range of bandwidths, dynamic spectrum sharing, channel modelling and wave propagation for ultra-dense wireless networks, as well as price pressures. The choice of an antenna system will also be a critical component of all node end devices and will present several design challenges such as size, purpose, shape and placement. In this edited book, the authors bring new approaches for exploiting challenging propagation channels and the development of efficient, cost-effective, scalable, and reliable antenna systems and solutions, as well as future perspectives. The book is aimed at a wide audience of industry and academic researchers, scientists and engineers as well as advanced students in the field of antennas, ICTs, signal processing and electromagnetics. It will also be useful to network and system designers, developers and manufacturers. Stakeholders, government regulators, policy makers and standards bodies can use the information provided here to better understand the effects of the technology on the market and future developments for 5G and beyond systems and networks.

Antennas: Dec 09 2020 Antennas From Theory to Practice Comprehensive coverage of the fundamentals and latest developments in antennas and antenna design. In the newly revised Second Edition of *Antennas: From Theory to Practice*, renowned researcher, engineer, and author Professor Yi Huang delivers comprehensive and timely coverage of issues in modern antenna design and theory. Practical and accessible, the book is written for engineers, researchers, and students who work with radio frequency/microwave engineering, radar, and radio communications. The book details the basics of transmission lines, radiowaves and propagation, antenna theory, antenna analysis and design using industrial standard design software tools and the theory of characteristic modes, antenna measurement equipment, facilities, and techniques. It also covers the latest developments in special topics, like small and mobile antennas, wide- and multi-band antennas, automotive antennas, RFID, UWB, metamaterials, reconfigurable and MIMO antennas, and more. The new edition includes up to date information on a wide variety of newly relevant topics and trends, like adaptive impedance matching, the theory of characteristic modes, antenna materials and fabrication processes, and over-the-air (OTA) antenna system measurements. Many questions and examples are provided which enhances the learning experience. The book covers: An introduction to circuit concepts and transmission lines, including lumped and distributed element systems, transmission line theory, and the Smith Chart. An exploration of field concepts and radiowaves, including wave equations and solutions and radiowave propagation mechanisms, characteristics, and models. Discussions of antenna basics and popular antennas, including wire-type antennas, aperture-type antennas, and antenna arrays. Information about antenna manufacturing and measurements, including antenna measurement facilities and methods. The use of industrial standard simulation tools for antenna design and analysis. Perfect for engineers and researchers who work in RF engineering or radar and radio communications, *Antennas: From Theory to Practice, Second Edition* will also earn a place on the bookshelves of university students seeking a concise and practical introduction to the basics of antennas and antenna design.

Multifunctional Ultrawideband Antennas _____ Feb 20 2022 Multifunctional Antennas (MFA) are comparatively a new area for antenna research and finds applications in various modern wireless radios, like Cognitive Radio (CR) in Software Defined Radio (SDR) technology and MIMO technology. This book is first attempt and an invaluable resource which deals with the design and realization of various kinds of multifunctional antennas. After clearly explaining the exclusive features of MFAs, the book presents various designs of such antennas considering versatile modern and upcoming applications. Written by three internationally known researchers, *Multi-Functional Ultra Wideband Antennas: Trends, Techniques and Applications* Provides a lucid introduction on UWB systems, historical perspective and discusses various applications of such systems. Discusses fundamentals of antennas and its characterization in time and frequency domains, primarily aimed for the beginners in the area. Revisits the design and realization of various classical UWB antennas. Discusses various techniques of designing frequency-notched UWB antennas and provide detailed comparison of the techniques. Deals with the techniques of deriving multiple antenna functionalities from a single antenna. Incorporates exclusive discussions on modern reconfigurable antennas and printed and dielectric resonator based MIMO antennas with clear focus on recent and upcoming technological requirements. With *Multi-Functional Ultra Wideband Antennas: Trends, Techniques and Applications*, antenna engineers, communication system engineers, graduate students, academic/industry researchers will gain a thorough knowledge on design of such antennas with clear physical insight and understanding. Chinmoy Saha, PHD, is an associate Professor in the Department of Avionics at Indian Institute of Space Science and Technology, Thiruvananthapuram, Kerala, India. His current research interest includes Microwave Circuits, Engineered Materials, Metamaterial Inspired Antennas and Circuits, reconfigurable and multi-functional antennas for modern wireless applications, Dielectric Resonator antennas, THz antennas and wireless power transfer. He is the author or coauthor of several books, scientific journals and recipient of several prestigious awards. Jawad Yaseen Siddiqui, PHD, is an associate Professor in the Department of Radio Physics and Electronics at University of Calcutta, Kolkata, India. His current research interest includes ultra-wideband antennas, frequency reconfigurable antennas, tapered slot antennas and multi-functional antennas for cognitive radio application. He is the author or coauthor of several books, scientific journals and recipient of prestigious awards. He is a Co-Principal Investigator on Stratosphere Troposphere (ST) Radar Project at the University of Calcutta, Kolkata, India. Yahia M.M. Antar, PHD, is a Professor in the Department of Electrical and Computer Engineering at the Royal Military College of Canada, Kingston, ON, Canada. He is the author or coauthor of several books, scientific journals and recipient of prestigious awards which includes IEEE-Antennas and Propagation Society prestigious Chen-To-Tai Distinguished Educator Award for 2017, 2015 IEEE Canada J. M. Ham outstanding Engineering Education Award, 2014 IEEE Canada RA Fessenden Silver Medal, 2012 Queen's Diamond Jubilee Medal from the Governor General of Canada and many more.

Characteristic Modes _____ May 02 2020 Describes how to systematically implement various characteristic mode (CM) theories into designs of practical antenna systems. This book examines both theoretical developments of characteristic modes (CMs) and practical developments of CM-based methodologies for a variety of critical antenna designs. The book is divided into six chapters. Chapter 1 provides an introduction and discusses the recent advances of the CM theory and its applications in antenna engineering. Chapter 2 describes the formulation of the characteristic mode theory for perfectly electrically conducting (PEC) bodies and discusses its numerical implementations. Chapter 3 presents the CM theory for PEC structures embedded in multilayered medium and its applications. Chapter 4 covers recent advances in CM theory for dielectric bodies and also their applications. Chapter 5 discusses the CM theory for N-port networks and its applications to the design of antenna arrays. Finally, Chapter 6 discusses the design of platform-integrated antenna systems using characteristic modes. This book features the following: Introduces characteristic mode theories for various electromagnetic structures including PEC bodies, structures in multilayered medium, dielectric bodies, and N-port networks. Examines CM applications in electrically small antennas, microstrip patch antennas, dielectric resonator antennas, multipoint antennas, antenna arrays, and platform mounted antenna systems. Discusses numerical algorithms for the implementation of the characteristic mode theories in computer code. *Characteristic Modes: Theory and Applications in Antenna Engineering* will help antenna researchers, engineers, and students find new solutions for their antenna design challenges.

Advanced Antenna Array Engineering for 6G and Beyond Wireless Communications _____ Aug 24 2019 *Advanced Antenna Array Engineering for 6G and Beyond Wireless Communications* Reviews advances in the design and deployment of antenna arrays for future generations of wireless communication systems, offering new solutions for the telecommunications industry. *Advanced Antenna Array Engineering for 6G and Beyond Wireless Communications* addresses the challenges in designing and deploying antennas and antenna arrays which deliver 6G and beyond performance with high energy efficiency and possess the capability of being immune to interference caused by different systems mounted on the same platforms. This timely and authoritative volume presents innovative solutions for developing integrated communications networks of high-gain, individually-scannable, multi-beam antennas that are reconfigurable and conformable to all platforms, thus enabling the evolving integrated land, air and space communications networks. The text begins with an up-to-date discussion of the engineering issues facing future wireless communications systems, followed by a detailed discussion of different beamforming networks for multi-beam antennas. Subsequent chapters address problems of 4G/5G antenna collocation, discuss differentially-fed antenna arrays, explore conformal transmit arrays for airborne platforms, and present latest results on fixed frequency beam scanning leaky wave antennas as well as various analogue beam synthesizing strategies. Based primarily on the authors' extensive work in the field, including original research never before published, this important new volume: Reviews multi-beam feed networks, array decoupling and de-scattering methods. Provides a systematic study on differentially fed antenna arrays that are resistant to interference caused by future multifunctional/multi-generation systems. Features previously unpublished material on conformal transmit arrays based on Huygen's metasurfaces and reconfigurable leaky wave antennas. Includes novel algorithms for synthesizing and optimizing thinned massive arrays, conformal arrays, frequency invariant arrays, and other future arrays. *Advanced Antenna Array Engineering for 6G and Beyond Wireless Communications* is an invaluable resource for antenna engineers and researchers, as well as graduate and senior undergraduate students in the field.

MIMO Antennas for Wireless Communication _____ May 26 2022 The desired objective of this book is to investigate diversity and mutual coupling effects on MIMO antenna designs for WLAN/WiMAX/LTE applications, controlled with diversity and ground modification techniques including equivalent circuit diagrams. Diversity techniques in MIMO antennas leading to the performance improvement ratings are demonstrated and deliberated. The book contributes towards the development of 2:1 VSWR MIMO antennas with diversity techniques for indoor/outdoor applications for high data rate, QoS, and SNR. The improved MIMO antenna structures are investigated and presented in this book including part of massive MIMO to provide the important aspects of emerging technology. Aimed at researchers, professionals and graduate students in electrical engineering, electromagnetics, communications and signal processing including antenna theory and design, smart antennas, communication systems, this book: Investigates real time MIMO antenna designs for WLAN/WiMAX/LTE applications. Covers effects of ECC, MEG, TARC, and equivalent circuit. Addresses the coupling and diversity aspects of antenna design problem for MIMO systems. Focus on the MIMO

antenna designs for the real time applications. Exclusive chapter on 5G Massive MIMO along with case studies throughout the book.

Antenna Design for Mobile Devices Jan 22 2022 Expanded and updated, this practical guide is a one-stop design reference containing all an engineer needs when designing antennas Integrates state-of-the-art technologies with a special section for step-by-step antenna design Features up-to-date bio-safety and electromagnetic compatibility regulation compliance and latest standards Newly updated with MIMO antenna design, measurements and requirements Accessible to readers of many levels, from introductory to specialist Written by a practicing expert who has hired and trained numerous engineers

Antenna Engineering Handbook, Fourth Edition Sep 25 2019 The "bible of antenna engineering" fully updated to provide state-of-the-art coverage in antenna design and applications Edited by John L. Volakis, one of the world's leading authorities in antenna engineering, this trusted resource covers all the classic antenna types plus many new types and designs used in communications systems, satellites, radars, and emerging applications from WLAN to automotive systems to biomedical to smart antennas. You will also find expert discussion of topics critical to successful antenna design and engineering, such as measurement techniques and computational methods, a materials guide, wave propagation basics, microwave circuits, and matching techniques, as well as diversity and MIMO propagation models, frequency selective surfaces, and metamaterials. Packed with 1,500 illustrations, the 4th Edition of Antenna Engineering Handbook presents: Step-by-step guidance on most antennas (modern and classic) 59 chapters with 21 new chapters and 38 fully updated chapters from the previous edition Contributions from over 80 well-known antenna experts Full-color insert illustrating many commercial and military antennas Get Quick Access to All of Today's Cutting-Edge Antennas • Printed and Conformal Antennas • Wideband Patch Antennas • Wideband Arrays • Leaky-Wave Antennas • EBG Antennas • UWB Antennas and Arrays • Portable TV Antennas • Reconfigurable Antennas • Active Antennas • Millimeter Wave and TeraHertz Antennas • Fractal Antennas • Handset and Terminal Antennas • Biomedical Antennas • ECM and ESM antennas • Dielectric Resonator Antennas • Lens Antennas • Radiometer Antennas • Satellite Antennas • Reflector and Earth Station Antennas • and Dozens More!

MIMO Communication for Cellular Networks Dec 21 2021 As the theoretical foundations of multiple-antenna techniques evolve and as these multiple-input multiple-output (MIMO) techniques become essential for providing high data rates in wireless systems, there is a growing need to understand the performance limits of MIMO in practical networks. To address this need, MIMO Communication for Cellular Networks presents a systematic description of MIMO technology classes and a framework for MIMO system design that takes into account the essential physical-layer features of practical cellular networks. In contrast to works that focus on the theoretical performance of abstract MIMO channels, MIMO Communication for Cellular Networks emphasizes the practical performance of realistic MIMO systems. A unified set of system simulation results highlights relative performance gains of different MIMO techniques and provides insights into how best to use multiple antennas in cellular networks under various conditions. MIMO Communication for Cellular Networks describes single-user, multiuser, network MIMO technologies and system-level aspects of cellular networks, including channel modeling, resource scheduling, interference mitigation, and simulation methodologies. The key concepts are presented with sufficient generality to be applied to a wide range of wireless systems, including those based on cellular standards such as LTE, LTE-Advanced, WiMAX, and WiMAX2. The book is intended for use by graduate students, researchers, and practicing engineers interested in the physical-layer design of state-of-the-art wireless systems.

Innovation in Wearable and Flexible Antennas Apr 12 2021 This book deals with the design, numerical simulation, state of the art fabrication processes and methods, qualitative and quantitative tests, and measurement techniques of wearable and flexible antennas of different topologies, such as: Planar Inverted F, Printed Monopoles, Microstripes and Microstrips. Novel trends, materials, and fabrication and measurement techniques used in this vital field of antenna systems are also discussed. To the best of the editor's knowledge, at the time of publication, there are no published books targeting the vital topic of flexible antennas specifically and/or serving as a complete reference. There are only few books on wearable antennas that deal with specific applications and this has initiated a motivation to propose a book that would serve as a complete technical reference of the addressed technology. This book can serve as a reference source for Research and Development scientists, RF and antenna engineers working in this vital field; moreover, it could be used as a text book for Antenna Theory and Advanced Antennas courses which are mainly offered for graduate students.

Advances in Antenna, Signal Processing, and Microelectronics Engineering Oct 07 2020 With the rapid growth of wireless communications, this book meets the strong demand for information and new research in the area of antenna, signal processing, and microelectronics engineering. Providing an interdisciplinary platform, it brings together leading academicians, scientists, and researchers to share information on innovations, trends, and advances as well as the challenges encountered in this field. The chapters address the functional framework in the area of antenna, signal processing, and microelectronics engineering and explore the concepts from the basic to advanced level. Key features: • Addresses the functional framework in the area of antenna, signal processing, and microelectronics engineering • Covers the major challenges, issues, and advances in antennas, signal processing, and microelectronics engineering • Explores optimization techniques for smart antenna and microelectronics for different applications • Explores different materials and design techniques in the area of antennas and microelectronics

Novel Millimetre Wave Antennas for MIMO and 5G Applications Jun 26 2022 This book presents state-of-the-art millimetre wave antennas for next generation 5G communications. The propagation losses associated with the millimetre waves and the signal blockage due to the objects present between transmitter and receiver require novel antenna topologies to address these issues. Various aspects of antenna design related to millimetre wave 5G communication including 28-GHz channel characteristics, mmWave antenna requirements, antenna design strategies for 28 GHz, MIMO/multibeam antennas, and mmWave lens antennas are highlighted. Apart from the general antenna requirements and study related to the 28 GHz frequency band, various new metamaterial-based antennas employing uniaxial or biaxial anisotropic media that enhance the antenna radiation performance are covered in detail. In addition, various new antenna systems such as wide-scan antenna arrays, dual-polarized antennas, and dual-beam/multibeam antennas are covered in this book. The book concludes with the glimpses of the millimetre wave lens antennas and the design of very thin planar metamaterial lens for 5G massive MIMO applications.

MIMO Wireless Communications Aug 17 2021 Uniquely, this book proposes robust space-time code designs for real-world wireless channels. Through a unified framework, it emphasizes how propagation mechanisms such as space-time frequency correlations and coherent components impact the MIMO system performance under realistic power constraints. Combining a solid mathematical analysis with a physical and intuitive approach to space-time coding, the book progressively derives innovative designs, taking into consideration that MIMO channels are often far from ideal. The various chapters of this book provide an essential, complete and refreshing insight into the performance behaviour of space-time codes in realistic scenarios and constitute an ideal source of the latest developments in MIMO propagation and space-time coding for researchers, R&D engineers and graduate students. Features include • Physical models and analytical representations of MIMO propagation channels, highlighting the strengths and weaknesses of various models • Overview of space-time coding techniques, covering both classical and more recent schemes under information theory and error probability perspectives • In-depth presentation of how real-world propagation affects the capacity and the error performance of MIMO transmission schemes • Innovative and practical designs of robust space-time coding, precoding and antenna selection techniques for realistic propagation (including single-carrier and MIMO-OFDM transmissions) "This book offers important insights into how space-time coding can be tailored for real-world MIMO channels. The discussion of MIMO propagation models is also intuitive and well-developed." Arogyaswami J. Paulraj, Professor, Stanford University, CA "Finally a book devoted to MIMO from a new perspective that bridges the boundaries between propagation, channel modeling, signal processing and space-time coding. It is of high reference value, combining intuitive and conceptual explanations with detailed, stringent derivations of basic facts of MIMO." Ernst Bonek, Emeritus Professor, Technische Universität Wien, Austria • Presents space-time coding techniques for real-world MIMO channels • Contains new design methodologies and criteria that guarantee the robustness of space-time coding in real life wireless communications applications • Evaluates the performance of space-time coding in real world conditions

MIMO Antennas for Wireless Communication Sep 29 2022 The desired objective of this book is to investigate diversity and mutual coupling effects on MIMO antenna designs for WLAN/WiMAX/LTE applications, controlled with diversity and ground modification techniques including equivalent circuit diagrams. Diversity techniques in MIMO antennas leading to the performance improvement ratings are demonstrated and deliberated. The book contributes towards the development of 2:1 VSWR MIMO antennas with diversity techniques for indoor/outdoor applications for high data rate, QOS, and SNR. The improved MIMO antenna structures are investigated and presented in this book including part of massive MIMO to provide the important aspects of emerging technology. Aimed at researchers, professionals and graduate students in electrical engineering, electromagnetics, communications and signal processing including antenna theory and design, smart antennas, communication systems, this book: Investigates real time MIMO antenna designs for WLAN/WiMAX/LTE applications. Covers effects of ECC, MEG, TARC, and equivalent circuit. Addresses the coupling and diversity aspects of antenna design problem for MIMO systems. Focus on the MIMO antenna designs for the real time applications. Exclusive chapter on 5G Massive MIMO along with case studies throughout the book.

Microstrip and Printed Antennas: Applications-Based Designs Sep 05 2020 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 book is intended to serve as a practical microstrip and printed antenna design guide to cover various real-

world applications. All Antenna projects discussed in this book are designed, analyzed and simulated using full-wave electromagnetic solvers. Based on several years of the author's research in antenna design and development for RF and microwave applications, this book offers an in-depth coverage of practical printed antenna design methodology for modern applications.

Proceedings of Integrated Intelligence Enable Networks and Computing Nov 07 2020 This book presents best selected research papers presented at the First International Conference on Integrated Intelligence Enable Networks and Computing (IIENC 2020), held from May 25 to May 27, 2020, at the Institute of Technology, Gopeshwar, India (Government Institute of Uttarakhand Government and affiliated to Uttarakhand Technical University). The book includes papers in the field of intelligent computing. The book covers the areas of machine learning and robotics, signal processing and Internet of things, big data and renewable energy sources.

Fundamentals of Wireless Communication Oct 26 2019 This textbook takes a unified view of the fundamentals of wireless communication and explains cutting-edge concepts in a simple and intuitive way. An abundant supply of exercises make it ideal for graduate courses in electrical and computer engineering and it will also be of great interest to practising engineers.

Applications of Artificial Intelligence Techniques in Engineering Jul 24 2019 The book is a collection of high-quality, peer-reviewed innovative research papers from the International Conference on Signals, Machines and Automation (SIGMA 2018) held at Netaji Subhas Institute of Technology (NSIT), Delhi, India. The conference offered researchers from academic and industry the opportunity to present their original work and exchange ideas, information, techniques and applications in the field of computational intelligence, artificial intelligence and machine intelligence. The book is divided into two volumes discussing a wide variety of industrial, engineering and scientific applications of the emerging techniques.

Fundamentals of MIMO Wireless Communications Mar 12 2021 "Provides a solid understanding of the essential concepts of MIMO wireless communications"--

Printed Antennas for Wireless Communications Jul 04 2020 Printed antennas, also known as microstrip antennas, have a variety of beneficial properties including mechanical durability, conformability, compactness and cheap manufacturing costs. As such, they have a range of applications in both the military and commercial sectors, and are often mounted on the exterior of aircraft and spacecraft as well as incorporated into mobile radio communication devices. Printed Antennas for Wireless Communications offers a practical guide to state-of-the-art printed antenna technology used for wireless systems. Contributions from renowned global experts within both academia and industry enable the reader to design printed antennas and associated technologies, and offer valuable insights into important breakthroughs in these areas. Divided into 3 sections covering fundamental wideband printed radiating elements for wireless systems, small printed antennas for wireless systems, and advanced concepts and applications in wireless systems. Provides experimental data and applies theoretical models to present design performance trends and to give the reader an in-depth coverage of the area. Presents summaries of different approaches used in solving wireless systems such as WPAN (wireless personal area network) and MIMO (multi-input/ multi-output), offering the reader an overall perspective of the pros and cons of each. Focuses on practical design, examples and 'real world' solutions. Printed Antennas for Wireless Communications offers an excellent insight on printed antennas from the theoretical to the practical; hence it will appeal to practicing design engineers within commercial and governmental/ military organisations, as well as postgraduate students and researchers in communications technology

MIMO System Technology for Wireless Communications Nov 19 2021 For broadband communications, it was frequency division multiplexing. For optical communications, it was wavelength division multiplexing. Then, for all types of networks it was code division. Breakthroughs in transmission speed were made possible by these developments, heralding next-generation networks of increasing capability in each case. The basic idea is the same: more channels equals higher throughput. For wireless communications, it is space-time coding using multiple-input-multiple-output (MIMO) technology. Providing a complete treatment of MIMO under a single cover, MIMO System Technology for Wireless Communications assembles coverage on all aspects of MIMO technology along with up-to-date information on key related issues. Contributors from leading academic and industrial institutions around the world share their expertise and lend the book a global perspective. They lead you gradually from basic to more advanced concepts, from propagation modeling and performance analysis to space-time codes, various systems, implementation options and limitations, practical system development considerations, field trials, and network planning issues. Linking theoretical analysis to practical issues, the book does not limit itself to any specific standardization or research/industrial initiatives. MIMO is the catalyst for the next revolution in wireless systems, and MIMO System Technology for Wireless Communications lays a thorough and complete foundation on which to build the next and future generations of wireless networks.

MIMO Wireless Communications Jun 22 2019 Multiple-input multiple-output (MIMO) technology constitutes a breakthrough in the design of wireless communications systems, and is already at the core of several wireless standards. Exploiting multipath scattering, MIMO techniques deliver significant performance enhancements in terms of data transmission rate and interference reduction. This 2007 book is a detailed introduction to the analysis and design of MIMO wireless systems. Beginning with an overview of MIMO technology, the authors then examine the fundamental capacity limits of MIMO systems. Transmitter design, including precoding and space-time coding, is then treated in depth, and the book closes with two chapters devoted to receiver design. Written by a team of leading experts, the book blends theoretical analysis with physical insights, and highlights a range of key design challenges. It can be used as a textbook for advanced courses on wireless communications, and will also appeal to researchers and practitioners working on MIMO wireless systems.

Smart Antennas Feb 08 2021 Smart Antennas—State of the Art brings together the broad expertise of 41 European experts in smart antennas. They provide a comprehensive review and an extensive analysis of the recent progress and new results generated during the last years in almost all fields of smart antennas and MIMO (multiple-input multiple-output) transmission. The following represents a summarized table of content. Receiver: space-time processing, antenna combining, reduced rank processing, robust beamforming, subspace methods, synchronization, equalization, multiuser detection, iterative methods Channel: propagation, measurements and sounding, modelling, channel estimation, direction-of-arrival estimation, subscriber location estimation Transmitter: space-time block coding, channel side information, unified design of linear transceivers, ill-conditioned channels, MIMO-MAC strategies Network Theory: channel capacity, network capacity, multihop networks Technology: antenna design, transceivers, demonstrators and testbeds, future air interfaces Applications and Systems: 3G system and link level aspects, MIMO HSDPA, MIMO-WLAN/UMTS implementation issues This book serves as a reference for scientists and engineers who need to be aware of the leading edge research in multiple-antenna communications, an essential technology for emerging broadband wireless systems.

Antennas May 14 2021 Practical, concise and complete reference for the basics of modern antenna design Antennas: from Theory to Practice discusses the basics of modern antenna design and theory. Developed specifically for engineers and designers who work with radio communications, radar and RF engineering, this book offers practical and hands-on treatment of antenna theory and techniques, and provides its readers the skills to analyse, design and measure various antennas. Key features: Provides thorough coverage on the basics of transmission lines, radio waves and propagation, and antenna analysis and design Discusses industrial standard design software tools, and antenna measurement equipment, facilities and techniques Covers electrically small antennas, mobile antennas, UWB antennas and new materials for antennas Also discusses reconfigurable antennas, RFID antennas, Wide-band and multi-band antennas, radar antennas, and MIMO antennas Design examples of various antennas are provided Written in a practical and concise manner by authors who are experts in antenna design, with experience from both academia and industry This book will be an invaluable resource for engineers and designers working in RF engineering, radar and radio communications, seeking a comprehensive and practical introduction to the basics of antenna design. The book can also be used as a textbook for advanced students entering a profession in this field.

Multifunctional MIMO Antennas Jul 28 2022 This reference text presents a comprehensive approach for studying antenna design for various applications such as 5G communication, Internet of Things (IoT), and wearable devices. The text begins by discussing models, design, and development of MIMO antenna and antenna performance measurement and is followed by 5G communication challenges and opportunities and MIMO antennas for LTE/ISM applications. It covers important topics including mmWave antenna, antenna array for MIMO application, reconfigurable/band-notched MIMO antenna, multi-band MIMO antenna, wideband MIMO antenna, and fractal-based compact multiband hybrid antennas. The text will be useful for undergraduate, graduate students, and academic researchers in areas including electrical engineering, electronics, and communication engineering. Discussing three important aspects of antennas including the requirement of an advanced antenna, their performance analysis, and applications, this text will be useful for undergraduate, graduate students, and academic researchers in areas including electrical engineering, electronics, and communication engineering. It will further discuss modeling, simulation, and specific absorption rate (SAR) analysis of antennas. Short Blur: The text provides comprehensive coverage of antenna design for diverse applications including long-term evolution for wireless broadband communication. It will be a useful reference text for undergraduate, graduate students, and academic researchers in areas including electrical engineering, electronics, and communication engineering.

Next-Generation Antennas Oct 19 2021 NEXT-GENERATION ANTENNAS: ADVANCES AND CHALLENGES The first book in this exciting new series, written and edited by a group of international experts in the field, this exciting new volume covers the latest advances and challenges in the next generation of antennas. Antenna design and wireless communication has recently witnessed their fastest growth period ever in history, and these trends are likely to continue for the foreseeable future. Due to recent advances in industrial applications as well as antenna, wireless communication, and 5G technology, we are witnessing a variety of developing and expanding new technologies. Compact and low-cost

antennas are increasing the demand for ultra-wide bandwidth in next-generation (5G) wireless communication systems and the Internet of Things (IoT). Enabling the next generation of high-frequency communication, various methods have been introduced to achieve reliable high data rate communication links and enhance the directivity of planar antennas. 5G technology can be used in many applications, such as in smart city applications and in smartphones. This technology can satisfy the fast rise in user and traffic capacity in mobile broadband communications. Therefore, different planar antennas with intelligent beamforming capability play an important role in these areas. The purpose of this book is to present the advanced technology, developments, and challenges in antennas for next-generation antenna communication systems. This book covers advances in next-generation antenna design and application domain in all related areas. It is a detailed overview of cutting-edge developments and other emerging topics and their applications in all areas of engineering that have achieved great accuracy and performance with the help of the advancement and challenges in next-generation antennas. This outstanding new volume: Covers all the latest developments and future aspects of antenna communication. Is concisely written, lucid, and comprehensive, practical application-based, with many informative graphics and schematics. Will help students, researchers, as well as systems designers to understand fundamental antenna design and wireless communication. Compares different approaches in antenna design.

Smart Antennas Jan 28 2020 This book presents the latest techniques for the design of antenna, focusing specifically on the microstrip antenna. The authors discuss antenna structure, defected ground, MIMO, and fractal design. The book provides the design of microstrip antenna in terms of latest applications and uses in areas like IoT and device-to-device communication. The book also provides the current methods and techniques used for the enhancement of the performance parameters of the microstrip antenna. Chapters enhance the knowledge and skills of students and researchers in the latest in the communications world like IoT, D2D, satellite, wearable devices etc. The authors discuss applications such as microwave imaging, medical implants, hyperthermia treatments, and wireless wellness monitoring and how a decrease in size of antenna help facilitate application potential. Provides the latest techniques used for the design of antenna in terms of its structure, defected ground, MIMO and fractal design; Outlines steps to resolve issues with designing antenna, including the latest design and design parameters for microstrip antenna; Presents the design of conformal and miniaturized antenna structures for various applications.

Wireless Communications over MIMO Channels Jun 02 2020 Wireless Communications over MIMO Channels: Applications to CDMA and Multiple Antenna Systems covers both, state-of-the-art channel coding concepts and CDMA and multiple antenna systems, rarely found in other books on the subject. Furthermore, an information theoretical analysis of CDMA and SDMA systems illuminate ultimate limits and demonstrates the high potential of these concepts. Besides spatial multiplexing, the use of multiple transmit antennas in order to increase the link reliability by diversity concepts (space-time coding) is described. Another focus is the application of error control coding in mobile radio communications. Accompanying appendices include: basic derivations, tables of frequently used channel models, chain rules for entropy and information, data processing theorem, basics of linear algebra, Householder reflection and Givens rotation, and the LLL algorithm for lattice reduction.

Microstrip Antenna Design for Wireless Applications Jun 14 2021 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 the 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 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.

Millimetre Wave Antennas for Gigabit Wireless Communications Jan 10 2021 Complete and comprehensive application-focused reference on millimetre wave antennas. Millimetre Wave Antennas for Gigabit Wireless Communications covers a vast wealth of material with a strong focus on the current design and analysis principles of millimetre wave antennas for wireless devices. It provides practising engineers with the design rules and considerations required in designing antennas for the terminal. The authors include coverage of new configurations with advanced angular and frequency filtering characteristics, new design and analysis techniques, and methods for filter miniaturization. The book reviews up-to-date research results and utilizes numerous design examples to emphasize computer analysis and synthesis whilst also discussing the applications of commercially available software. Key Features: Advanced and up-to-date treatment of one of the fastest growing fields of wireless communications. Covers topics such as Gigabit wireless communications and its required antennas, passive and active antenna design and analysis techniques, multibeam antennas and MIMO, IEEE 802.15.3c, WiMedia®, and advanced materials and technologies. Offers a practical guide to integrated antennas for specific configurations requirements. Addresses a number of complex, real-world problems that system and antenna engineers are going to face in millimetre-wave communications industry and provides solutions. Contains detailed design examples, drawings and predicted performance. This book is an invaluable tool for antenna professionals (engineers, designers, and developers), microwave professionals, wireless communication system professionals, and industries with microwave and millimetre wave research projects. Advanced students and researchers working in the field of millimetre wave engineering will also find this book very useful.

Advanced Antenna Systems for 5G Network Deployments Jul 16 2021 Advanced Antenna Systems for 5G Network Deployments: Bridging the Gap between Theory and Practice provides a comprehensive understanding of the field of advanced antenna systems (AAS) and how they can be deployed in 5G networks. The book gives a thorough understanding of the basic technology components, the state-of-the-art multi-antenna solutions, what support 3GPP has standardized together with the reasoning, AAS performance in real networks, and how AAS can be used to enhance network deployments. Explains how AAS features impact network performance and how AAS can be effectively used in a 5G network, based on either NR and/or LTE. Shows what AAS configurations and features to use in different network deployment scenarios, focusing on mobile broadband, but also including fixed wireless access. Presents the latest developments in multi-antenna technologies, including Beamforming, MIMO and cell shaping, along with the potential of different technologies in a commercial network context. Provides a deep understanding of the differences between mid-band and mm-Wave solutions.

Printed MIMO Antenna Engineering Oct 31 2022 Wireless communications has made a huge leap during the past two decades. The multiple-input-multiple-output (MIMO) technology was proposed in the 1990's as a viable solution that can overcome the data rate limit experienced by single-input-single-output (SISO) systems. This resource is focused on printed MIMO antenna system design. Printed antennas are widely used in mobile and handheld terminals due to their conformity with the device, low cost, good integration within the device elements and mechanical parts, as well as ease of fabrication. A perfect design companion for practicing engineers, this book provides full design examples from literature, along with detailed illustrations for the various antenna geometries. This resource overviews the various applications that currently depend on printed MIMO antennas, and provides design guidelines and remarks throughout the book for guidance.

Multifunctional MIMO Antennas: Fundamentals and Application Aug 29 2022 This book presents a comprehensive approach to antenna designs for various applications, including 5G communication, the internet of things (IoT), and wearable devices. It discusses models, designs, and developments of MIMO antennas, antenna performance measurement, 5G communication challenges and opportunities, and MIMO antennas for LTE/ISM applications. It covers important topics including mmWave antennas, antenna arrays for MIMO applications, reconfigurable/band-notched MIMO antennas, multiband MIMO antennas, wideband MIMO antennas, and fractal-based compact multiband hybrid antennas. FEATURES Discusses antenna design optimization techniques in detail. Covers MIMO antenna performance measurement, multiband MIMO antennas, and wideband MIMO antennas. Discusses modeling, simulation, and specific absorption rate (SAR) analysis of antennas. Provides applications including radio-frequency identification (RFID), wearable antennas, and antennas for IoT. Multifunctional MIMO Antennas: Fundamentals and Application is useful for undergraduate and graduate students and academic researchers in areas including electrical engineering, electronics, and communication engineering.

Antenna Engineering Handbook Mar 24 2022 The gold-standard reference on the design and application of classic and modern antennas—fully updated to reflect the latest advances and technologies. This new edition of the “bible of antenna engineering” has been updated to provide start-to-finish coverage of the latest innovations in antenna design and application. You will find in-depth discussion of antennas used in modern communication systems, mobile and personal wireless technologies, satellites, radar deployments, flexible electronics, and other emerging technologies, including 5G, terahertz, and wearable electronics. Antenna Engineering Handbook, Fifth Edition, is bolstered by real-world examples, hundreds of illustrations, and an emphasis on the practical aspects of antennas. Featuring 60 chapters and contributions from more than 80 renowned experts, this acclaimed resource is edited by one of the world's leading antenna authorities. This edition features all of the classic antenna types, plus new and emerging designs, with 13 all-new chapters and important updates to nearly all chapters from past editions. Antenna Engineering Handbook, Fifth Edition, clearly explains cutting-edge applications in WLANs, automotive

systems, PDAs, and handheld devices, making it an indispensable companion for today's antenna practitioners and developers. Coverage includes: •Antenna basics and classic antennas•Design approaches for antennas and arrays•Wideband and multiband antennas•Antennas for mobile devices and PDAs, automotive applications, and aircraft•Base station and smart antennas•Beamforming and 5G antennas•Millimeter-wave and terahertz antennas•Flexible, wearable, thin film, origami, dielectric, and on-chip antennas•MIMO antennas and phased arrays•Direction-finding and GPS antennas•Active antennas•Low-profile wideband antennas•Nanoantennas•Reflectors and other satellite and radio-telescope antennas•Low-frequency, HF, VHF, UHF, ECM, and ESM antennas•Impedance-matching techniques and material characteristics•Metastructured and frequency selective surfaces•Propagation and guided structures•Computational techniques and toolsets•Indoor and outdoor measurements

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