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The idea for this book originated from a Special Session on Circuits and Systems for Future Generations of Wireless Communications that was presented at the 2005 InternationalSymposiumon Circuits and Systems, which was then followed by two Special Issues bearing the same title that appeared in the March and April 2008 issues of the IEEE Transactions on Circuits and Systems – Part II: Express Briefs. Out of a large number of great contributions, we have selected those tting best the book format based on their quality. We would like to thank all the authors, the reviewers of the Transactions on Circuits and Systems – Part II, and the reviewers of the nal book material for their efforts in creating this manuscript. We also thank the Springer Editorial Staff for their support in putting together all the good work. We hope that this book will provide you, the reader, with new insights into Circuits and Systems for Future Generations of Wireless Communications.

The third volume of the influential WWRF Book of Visions of research and trends in mobile communications has been fully updated. It includes three new chapters on flexible spectrum use, ultra-broadband convergent home-area networks, and the system concept. Visions from manufacturers, network operators, research institutes and academia from all over world are captured by the WWRF in one comprehensive single point of reference. Technologies for the Wireless Future, Volume 3 describes the expectations and requirements of a user in the ‘future wireless world’ between 2010 and 2017. This will enable readers to prioritise research topics based on the provision of cost-effective solutions. This book is ideal for researchers from both academia and industry, as well as engineers, managers, strategists, and regulators. WWRF has become highly influential on the future of wireless communication. You can see the evidence already, as many of the concepts described in the very first Book of Vision have been adopted in today’s wireless implementations. The organization brings together the long-range views of academia with the practical constraints and requirements of industry. This is a powerful combination. Mark Pecen, Vice President, Research In Motion Limited The WWRF Book of Vision series of books are an invaluable source of information for key thoughts and technology developments in wireless and mobile communication. The comprehensiveness and diversified nature of its research reports and results can prove to be a very useful tool in planning and developing the next generation network and services. Bill Huang, General Manager, China Mobile Research As mobile broadband becomes part of our daily lives, in the same way that mobile telephony has done, and helps us to support important issues such as health care, education and many other priorities, WWRF is again exploring the options for mobile and wireless systems in its' third edition of the Book of Visions. Earlier versions have helped to reach global consensus on research objectives, reduce investment risk and generate critical mass in research efforts. The third book of visions provides key insights into the international academic and commercial discussion on tomorrows' hot topics in mobile research! Håkan Eriksson, Senior Vice President, CTO, Ericsson

mmWave Massive MIMO: A Paradigm for 5G is the first book of its kind to hinge together related discussions on mmWave and Massive MIMO under the umbrella of 5G networks. New networking scenarios are identified, along with fundamental design requirements for mmWave Massive MIMO networks from an architectural and practical perspective. Working towards final deployment, this book updates the research community on the current mmWave Massive MIMO roadmap, taking into account the future emerging technologies emanating from 3GPP/IEEE. The book's editors draw on their vast experience in international research on the forefront of the mmWave Massive MIMO research arena and standardization. This book aims to talk openly about the topic, and will serve as a useful reference not only for postgraduates students to learn more on this evolving field, but also as inspiration for mobile communication researchers who want to make further innovative strides in the field to mark their legacy in the 5G arena. Contains tutorials on the basics of mmWave and Massive MIMO Identifies new 5G networking scenarios, along with design requirements from an architectural and practical perspective Details the latest updates on the evolution of the mmWave Massive MIMO roadmap, considering future emerging technologies emanating from 3GPP/IEEE Includes contributions from leading experts in the field in modeling and prototype design for mmWave Massive MIMO design Presents an ideal reference that not only helps postgraduate students learn more in this evolving field, but also inspires mobile communication researchers towards further innovation

Wireless communication is one of the fastest growing fields in the engineering world today. Rapid growth in the domain of wireless communication systems, services and application has drastically changed the way we live, work and communicate. Wireless communication offers a broad and dynamic technological field, which has stimulated incredible excitements and technological advancements over last few decades. The expectations from wireless communication technology are increasing every day. This is placing enormous challenges to wireless system designers. Moreover, this has created an ever increasing demand for conceptually strong and well versed communication engineers who understand the wireless technology and its future possibilities. In recent years, significant progress in wireless communication system design has taken place, which will continue in future. Especially for last two decades, the research contributions in wireless communication system design have resulted in several new concepts and inventions at remarkable speed. A text book is indeed required to offer familiarity with such developments and underlying concepts, to be taught in the classroom to future engineers. This is one of the motivations for writing this book. Practically no book can be up to date in this field, due to the fast ongoing research and developments. The new developments are announced almost every day. Teaching directly from the research papers in the classroom cannot build the necessary foundation. Therefore need for a textbook is unavoidable, which is integral to learning, and is an essential source to build the concept. The prime goal of this book is to cooperate in the learning process. This book is based on current research as well as classical text books in the field, and aims to provide in depth understanding on fundamental concepts, which form the basis of wireless communication and build the platform, on which current developments can be understood and future contributions can be made. This book is written in self-explanatory manner to facilitate critical thinking and to support self study. Special emphasis has been given in this book to systematically organize and present the wide domain of wireless communication technology. Extra care has been taken to present the contents and the concepts in user friendly way to enable an easy understanding. Therefore the language of this book is made to make one feel, listening to a classroom lecture. This makes learning straight forward. Sometimes, the explanation could seem to be oversimplified, this is in order to support wide spectrum of readers as well as to clarify the hazy picture. A book of this kind, which addresses a fast developing technology, the frequent use of acronyms and abbreviations is almost inevitable. A care has been taken to spell the acronyms and abbreviations as frequently as practically suitable in the text. Besides, a list of acronyms and abbreviations has also been provided.

The key to a successful future mobile communication system lies in the design of its radio scheduler. One of the key challenges of the radio scheduler is how to provide the right balance between Quality of Service (QoS) guarantees and the overall system performance. Yasir Zaki proposes innovative solutions for the design of the Long Term Evolution (LTE) radio scheduler and presents several LTE radio scheduler analytical models that can be used as efficient tools for radio dimensioning. The author also introduces a novel wireless network virtualization framework and highlights the potential gains of using this framework for the future network operators. This framework enables the operators to share their resources and reduce their cost, thus achieving a better overall system performance and radio resource utilization.

The Book contains the Vision of the researchers of the European Network of Excellence NEWCOM++ (Network of Excellence on Wireless COMmunication) on the present and future status of Wireless Communication Networks. In its content, the community of NEWCOM++ researchers, shaped under the common ground of a mainly academic network of excellence, have distilled their scientific wisdom in a number of areas characterized by the common denominator of wireless communications, by identifying the medium-long term research tendencies/problems, describing the tools to face them and providing a relatively large number of references for the interested reader. The identified areas and the researchers involved in their redaction reflect the intersection of the major topics in wireless communications with those that are deeply investigated in NEWCOM++; they are preceded by an original description of the main trends in user/society needs and the degree of fulfilment that ongoing and future wireless communications standards will more likely help achieving. The appendix of the Book contains a list of "Millenium Problems", seminal problems in the area of wireless communication networks, characterized by being crucial and still unsolved. The problems have been identified by NEWCOM++ researchers and filtered by the editors of the Vision Book.

The book will begin by evaluating the state of the art of all current mobile generations' while looking into their core building blocks. 6G implementation will require fundamental support from Artificial Intelligence (AI) and Machine Learning on the network's edge and core, including a new Radio Frequency (RF) spectrum.

This fully updated second volume of the highly successful WWRF Book of Visions is a unique and timely book, presenting up-to-the-minute ideas and trends in mobile communications. This is a comprehensive single point of reference, focusing on the specifications and requirements of 4G and identifying potential business models, the research areas and required spectrum and enabling technologies. Comprising material from White Papers edited within the working expert groups as well as those from the Vision Committee of WWRF, a top-down approach has been adopted starting from perceived users requirements and their expectations in the Future Wireless World.

ADVANCEDWIRELESSCOMMUNICATIONSAND INTERNET THIRD EDITION ADVANCEDWIRELESSCOMMUNICATIONSAND INTERNET Future Evolving Technologies The new edition of Advanced Wireless Communications: 4G Cognitive and Cooperative Broadband Technology, 2nd Edition, including the latest developments In the evolution of wireless communications, the dominant challenges are in the areas of networking and their integration with the Future Internet. Even the classical concept of cellular networks is changing and new technologies are evolving to replace it. To reflect these new trends, Advanced Wireless Communications & INTERNET builds upon the previous volumes, enhancing the existing chapters, and including a number of new topics. Systematically guiding readers from the fundamentals through to advanced areas, each chapter begins with an introductory explanation of the basic problems and solutions followed with an analytical treatment in greater detail. The most important aspects of new emerging technologies in wireless communications are comprehensively covered including: next generation Internet; cloud computing and network virtualization; economics of utility computing and wireless grids and clouds. This gives readers an essential understanding of the overall environment in which future wireless networks will be operating. Furthermore, a number of methodologies for maintaining the network connectivity, by using tools ranging from genetic algorithms to stochastic geometry and random graphs theory, and a discussion on percolation and connectivity, are also offered. The book includes a chapter on network formation games, covering the general models, knowledge based network formation games, and coalition games in wireless ad hoc networks. Illustrates points throughout using real-life case studies drawn from the author’s extensive international experience in the field of telecommunications Fully updated to include the latest developments, key topics covered include: advanced routing and network coding; network stability control; relay-assisted Wireless Networks; multicommodity flow optimization problems, flow optimization in heterogeneous networks, and dynamic resource allocation in computing clouds Methodically guides readers through each topic from basic to advanced areas Focuses on system elements that provide adaptability and re-configurability, and discusses how these features can improve wireless communications system performance Enjoyed this book? Why not tell others about it and write a review on your favourite online bookseller.

This unique book reviews the future developments of short-range wireless communication technologies Short-Range Wireless Communications: Emerging Technologies and Applications summarizes the outcomes of WWRF Working Group 5, highlighting the latest research results and emerging trends on short-range communications. It contains contributions from leading research groups in academia and industry on future short-range wireless communication systems, in particular 60 GHz communications, ultra-wide band (UWB) communications, UWB radio over optical fiber, and design rules for future cooperative short-range communications systems. Starting from a brief description of state-of-the-art, the authors highlight the perspectives and limits of the technologies and identify where future research work is going to be focused. Key Features: Provides an in-depth coverage of wireless technologies that are about to start an evolution from international standards to mass products, and that will influence the future of short-range communications Offers a unique and invaluable visionary overview from both industry and academia Identifies open research problems, technological challenges, emerging technologies, and fundamental limits Covers ultra-high speed short--range communication in the 60 GHz band, UWB communication, limits and challenges, cooperative aspects in short-range communication and visible light communications, and UWB radio over optical fiber This book will be of interest to research managers, R&D engineers, lecturers and graduate students within the wireless communication research community. Executive managers and communication engineers will also find this reference useful.

This book provides a preview of emerging wireless technologies and their architectural impact on the future mobile Internet. The reader will find an overview of architectural considerations for the

mobile Internet, along with more detailed technical discussion of new protocol concepts currently being considered at the research stage. The first chapter starts with a discussion of anticipated mobile/wireless usage scenarios, leading to an identification of new protocol features for the future Internet. This is followed by several chapters that provide in-depth coverage of next-generation wireless standards, ad hoc and mesh network protocols, opportunistic delivery and delay tolerant networks, sensor network architectures and protocols, cognitive radio networks, vehicular networks, security and privacy, and experimental systems for future Internet research. Each of these contributed chapters includes a discussion of new networking requirements for the wireless scenario under consideration, architectural concepts and specific protocol designs, many still at research stage.

The major expectation from the fourth generation (4G) of wireless communication networks is to be able to handle much higher data rates, allowing users to seamlessly reconnect to different networks even within the same session. Advanced Wireless Networks gives readers a comprehensive integral presentation of the main issues in 4G wireless networks, showing the wide scope and inter-relation between different elements of the network. This book adopts a logical approach, beginning each chapter with introductory material, before proceeding to more advanced topics and tools for system analysis. Its presentation of theory and practice makes it ideal for readers working with the technology, or those in the midst of researching the topic. Covers mobile, WLAN, sensor, ad hoc, bio-inspired and cognitive networks as well as discussing cross-layer optimisation, adaptability and reconfigurability Includes hot topics such as network management, mobility and hand-offs, adaptive resource management, QoS, and solutions for achieving energy efficient wireless networks Discusses security issues, an essential element of working with wireless networks Supports the advanced university and training courses in the field and includes an extensive list of references Providing comprehensive coverage of the current status of wireless networks and their future, this book is a vital source of information for those involved in the research and development of mobile communications, as well as the industry players using and selling this technology. Companion website features three appendices: Components of CRE, Introduction to Medium Access Control and Elements of Queueing Theory

Provides an introduction to High-Altitude Platform Stations (HAPS) technology and its applications for wireless communications High-altitude platform stations offer a promising new technology that combines the benefits of terrestrial and satellite communication systems for delivering broadband communications to users at a low cost. They are easily deployable and easy to maintain, which is why they offer a good alternative for network operators who need to find ways to get more coverage to satisfy the increasing demand for more capacity. HAPS are usually balloons, airships or unmanned aerial systems (UAS) located in the stratosphere. An enormous interest has grown worldwide to examine their use not only for broadband communications, but also for emergency services, navigation, traffic monitoring, cellular, etc. Key features include: Unique book focusing on emerging HAPS technology and its applications Provides a thorough overview of the technology including HAPS-based communications systems, antennas for HAPS, radio propagation and channel modelling issues and HAPS networking aspects Presents various HAPS-related projects and initiatives developed throughout the world (North America, Europe and Asia-Pacific) Features a comprehensive overview on both aeronautical and telecommunications regulatory aspects, which will affect the deployment and future developments in the field of HAPS High-Altitude Platform Systems for Wireless Communications will prove essential reading for postgraduate students in the field of HAPS, engineers, developers and designers involved in the design and maintenance of HAPS, aerospace engineers, and communications system planners and researchers.

This book gathers visionary ideas from leading academics and scientists to predict the future of wireless communication and enabling technologies in 2050 and beyond. The content combines a wealth of illustrations, tables, business models, and novel approaches to the evolution of wireless communication. The book also provides glimpses into the future of emerging technologies, end-to-end systems, and entrepreneurial and business models, broadening readers’ understanding of potential future advances in the field and their influence on society at large

Communications: Wireless in Developing Countries and Networks of the Future The present book contains the proceedings of two conferences held at the World Computer Congress 2010 in Brisbane, Australia (September 20–23) organized by the International Federation for Information Processing (IFIP): the Third IFIP TC 6 Int- national Conference on Wireless Communications and Information Technology for Developing Countries (WCITD 2010) and the IFIP TC 6 International Network of the Future Conference (NF 2010). The main objective of these two IFIP conferences on communications is to provide a platform for the exchange of recent and original c- tributions in wireless networks in developing countries and networks of the future. There are many exiting trends and developments in the communications industry, several of which are related to advances in wireless networks, and next--generation Internet. It is commonly believed in the communications industry that a new gene- tion should appear in the next ten years. Yet there are a number of issues that are being worked on in various industry research and development labs and universities towards enabling wireless high--speed networks, virtualization techniques, smart n- works, high-level security schemes, etc. We would like to thank the members of the Program Committees and the external reviewers and we hope these proceedings will be very useful to all researchers int- ested in the fields of wireless networks and future network technologies.

Since the launch of Second-Generation Networks (2G), planning for each future mobile service was initiated many years before its commercial launch. In 2019, 5G Networks begun to be deployed commercially after almost ten years of planning. Similarly, the race for the 6G wireless networks that will be operational in 2030 has already started. To fulfill its potential in the upcoming decade, 6G will undoubtedly require an architectural orchestration based on the amalgamation of existing solutions and innovative technologies. The book will begin by evaluating the state of the art of all current mobile generations' while looking into their core building blocks. 6G implementation will require fundamental support from Artificial Intelligence (AI) and Machine Learning on the network's edge and core, including a new Radio Frequency (RF) spectrum. The 6G use cases will require advanced techniques for enabling the future wireless network to be human-centric, ensuring enhanced quality of experience (QoE) for most of its applications. The concept of Human Bond Communication Beyond 2050 (Knowledge Home) and Communication, Navigation, Sensing, and Services (CONASENSE) will also profit from future wireless communication. Terahertz domains will exploit the ultra-Massive Multiple Input Multiple Output Antennas (UM-MIMO) technologies to support Terabits' data throughputs.-Moreover, optical wireless communications (OWC) will also come into play to support indoor and outdoor high-data rates. Further expansion of 6G core entities will support the novel concept of Society 5.0. Quantum computing processing and communications is also likely to be added into the 6G ecosystem with security managed by blockchain orchestration for a robust network.

There has been a dramatic increase in the utilization of wireless technologies in healthcare systems as a consequence of the wireless ubiquitous and pervasive communications revolution. Emerging information and wireless communication technologies in health and healthcare have led to the creation of e-health systems, also known as e-healthcare, which have been drawing increasing attention in the public and have gained strong support from government agencies and various organizations. E-Healthcare Systems and Wireless Communications: Current and Future Challenges explores the developments and challenges associated with the successful deployment of e-healthcare systems. The book combines research efforts in different disciplines including pervasive wireless communications, wearable computing, context-awareness, sensor data fusion, artificial intelligence, neural networks, expert systems, databases, and security. This work serves as a comprehensive reference for graduate students in bioengineering and also provides solutions for medical researchers who are faced with the challenge of designing and implementing a cost-effective pervasive and ubiquitous wireless communication system.

Enabling Technologies for Next Generation Wireless Communications provides up-to-date information on emerging trends in wireless systems, their enabling technologies and their evolving application paradigms. This book includes the latest trends and developments toward next generation wireless communications. It highlights the requirements of next generation wireless systems, limitations of existing technologies in delivering those requirements and the need to develop radical new technologies. It focuses on bringing together information on various technological developments that are enablers vital to fulfilling the requirements of future wireless communication systems and their applications. Topics discussed include spectrum issues, network planning, signal processing, transmitter, receiver, antenna technologies, channel coding, security and application of machine learning and deep learning for wireless communication systems. The book also provides information on enabling business models for future wireless systems. This book is useful as a resource for researchers and practitioners worldwide, including industry practitioners, technologists, policy decision-makers, academicians, and graduate students.

Wireless channels are becoming more and more important, with the future development of wireless ad-hoc networks and the integration of mobile and satellite communications. To this end, algorithmic detection aspects (involved in the physical layer) will become fundamental in the design of a communication system. This book proposes a unified approach to detection for stochastic channels, with particular attention to wireless channels. The core idea is to show that the three main criteria of sequence detection, symbol detection and graph-based detection, can all be described within a general framework. This implies that a detection algorithm based on one criterion can be extended to the other criteria in a systematic manner. Presents a detailed analysis of statistical signal detection for digital signals transmitted over wireless communications Provides a unifying framework for different signal detection algorithms, such as sequence detection, symbol detection and graph-based detection, important for the design of modern digital receivers operating over mobile channels Features the hot topic of graph-based detection Detection Algorithms for Wireless Communications represents a novel contribution with respect to the current literature, with a unique focus on detection algorithms, as such it will prove invaluable to researchers working in academia and industry and in the field of wireless communications, as well as postgraduate students attending advanced courses on mobile communications.

This book focuses on the multidisciplinary state-of-the-art of full-duplex wireless communications and applications. Moreover, this book contributes with an overview of the fundamentals of full-duplex communications, and introduces the most recent advances in self-interference cancellation from antenna design to digital domain. Moreover, the reader will discover analytical and empirical models to deal with residual self-interference and to assess its effects in various scenarios and applications. Therefore, this is a highly informative and carefully presented book by the leading scientists in the area, providing a comprehensive overview of full-duplex technology from the perspective of various researchers, and research groups worldwide. This book is designed for researchers and professionals working in wireless communications and engineers willing to understand the challenges and solutions full-duplex communication so to implement a full-duplex system.

Backscattering and RF Sensing for Future Wireless Communication Discover what lies ahead in wireless communication networks with this insightful and forward-thinking book written by experts in the field Backscattering and RF Sensing for Future Wireless Communication delivers a concise and insightful picture of emerging and future trends in increasing the efficiency and performance of wireless communication networks. The book shows how the immense challenge of frequency saturation could be met via the deployment of intelligent planar electromagnetic structures. It provides an in--depth coverage of the fundamental physics behind these structures and assesses the enhancement of the performance of a communication network in challenging environments, like densely populated urban centers. The distinguished editors have included resources from a variety of leading voices in the field who discuss topics such as the engineering of metasurfaces at a large scale, the electromagnetic analysis of planar metasurfaces, and low-cost and reliable backscatter communication. All of the included works focus on the facilitation of the development of intelligent systems designed to enhance communication network performance. Readers will also benefit from the inclusion of: A thorough introduction to the evolution of wireless communication networks over the last thirty years, including the imminent saturation of the frequency spectrum An exploration of state-of-the-art techniques that next-generation wireless networks will likely incorporate, including software-controlled frameworks involving artificial intelligence An examination of the scattering of electromagnetic waves by metasurfaces, including how wave propagation differs from traditional bulk materials A treatment of the evolution of artificial intelligence in wireless communications Perfect for researchers in wireless communications, electromagnetics, and urban planning, Backscattering and RF Sensing for Future Wireless Communication will also earn a place in the libraries of government policy makers, technologists, and telecom industry stakeholders who wish to get a head start on understanding the technologies that will enable tomorrow’s wireless communications.

The following topics are dealt with: Future of mobile and wireless communications; optical radio-a review of a radical new technology for wireless access infrastructure; wireless LANs-present and future; future applications of bluetooth; ultrawideband and its capabilities; ad hoc wireless networks; scalability, capacity and local connectivity in ad hoc networks; the role of ad hoc networks in mobility; securing mobile ad hoc networks - a motivational approach; the use of satellite for multimedia communications; evolving systems beyond 3G-the 1st brain and mind projects; economic tussles in the public mobile access market; enabling applications deployment on mobile networks; the parlay API-allowing third party application providers safe and secure access to network capabilities; radio spectrum management for tetherless communications; mobile multimedia services; multimodality-the future of the wireless user interface; mobile video-streaming; a social history of the mobile telephone with a view of its future.

With the emergence of broadband wireless communication systems, new business opportunities have appeared for operators, content provides, and manufacturers. Broadband wireless communications technologies promise the freedom of constant access to the Internet at high speeds, without the limitation of connection cables. Broadband Wireless Communications Business provides comprehensive coverage of the present status and future evolution of these technologies, giving vital practical cost and benefit advice on design, construction and implementation. The author focuses on the costs associated with network design and operation, examining resources, maintenance and billing considerations in terms of Quality of Service provisioning. The future of 4G is explained, with enhancing technologies, cellular design topologies and ad-hoc technologies all covered in-depth. This book will enable the reader to make key business decisions: how to evaluate a technology, which to use, how to combine several technologies to reach a target market, how to differentiate from competitors and how to take advantage of future possible enhancements. Broadband Wireless Communications Business: Defines the unique technical features of the new broadband wireless communications sys-

tems and explains what these mean for operator and manufacturer businesses. Offers a complete guide to all current access technologies, associated standards, and duplex modes. Provides advice on key business cost and benefit issues. Addresses wireless technology from the point of view of numerous market sectors: public mobile systems, hot spot coverage, personal area networks, and multi-user shared usage of resources, etc. This text is essential for decision makers and industry key players responsible for the design, development, implementation and management of wireless telecommunications systems. Researchers specializing in the field of wireless technology and graduate students on telecommunications courses will also find it an excellent guide to the topic.

A comprehensive review to the theory, application and research of machine learning for future wireless communications In one single volume, Machine Learning for Future Wireless Communications provides a comprehensive and highly accessible treatment to the theory, applications and current research developments to the technology aspects related to machine learning for wireless communications and networks. The technology development of machine learning for wireless communications has grown explosively and is one of the biggest trends in related academic, research and industry communities. Deep neural networks-based machine learning technology is a promising tool to attack the big challenge in wireless communications and networks imposed by the increasing demands in terms of capacity, coverage, latency, efficiency flexibility, compatibility, quality of experience and silicon convergence. The author – a noted expert on the topic – covers a wide range of topics including system architecture and optimization, physical-layer and cross-layer processing, air interface and protocol design, beamforming and antenna configuration, network coding and slicing, cell acquisition and handover, scheduling and rate adaption, radio access control, smart proactive caching and adaptive resource allocations. Uniquely organized into three categories: Spectrum Intelligence, Transmission Intelligence and Network Intelligence, this important resource: Offers a comprehensive review of the theory, applications and current developments of machine learning for wireless communications and networks Covers a range of topics from architecture and optimization to adaptive resource allocations Reviews state-of-the-art machine learning based solutions for network coverage Includes an overview of the applications of machine learning algorithms in future wireless networks Explores flexible backhaul and front-haul, cross-layer optimization and coding, full-duplex radio, digital front-end (DFE) and radio-frequency (RF) processing Written for professional engineers, researchers, scientists, manufacturers, network operators, software developers and graduate students, Machine Learning for Future Wireless Communications presents in 21 chapters a comprehensive review of the topic authored by an expert in the field.

Here's a forward-looking new book that realistically forecasts the changes in mobile communications over the next 20 years to help you make informed decisions and develop successful strategies that address the future challenges of this industry. You get specific recommendations on which technological areas organizations should concentrate on, along with insightful discussions on technology and the limits of efficiency, standardization, radio spectrum, economics, industry structure, user requirements, and other constraints and drivers.

The past several years have been exciting for wireless communications. The public appetite for new services and equipment continues to grow. The Second Generation systems that have absorbed our attention during recent years will soon be commercial realities. In addition to these standard systems, we see an explosion of technical alternatives for meeting the demand for wireless communications. The debates about competing solutions to the same problem are a sign of the scientific and technical immaturity of our field. Here we have an application in search of technology rather than the reverse. This is a rare event in the information business. Happily, there is a growing awareness that we can act now to prevent the technology shortage from becoming more acute at the end of this decade. By then, market size and user expectations will surpass the capabilities of today's emerging systems. Third Generation Wireless Information Networks will place even greater burdens on technology than their ancestors. To discuss these issues, Rutgers University WINLAB plays host to a series of Workshops on Third Generation Wireless Information Networks. The first one, in 1989, had the flavor of a gathering of committed enthusiasts of an interesting niche of telephony. Presentations and discussions centered on the problems of existing cellular systems and technical alternatives to alleviating them. Although the more distant future was the announced theme of the Workshop, it drew only a fraction of our attention.

See the future through the vision of the Wireless World Research Forum. Technologies for the Wireless Future, the result of pioneering cooperative work of many academic and industrial researchers from WWRF, provides a wide picture of the research challenges for the future wireless world. Despite much emphasis on hard technology, the user is certainly not forgotten as this book provides an all-encompassing treatment of future wireless technologies ranging from user centred design processes and I-centric communications to end-to-end econfigurability and short-range wireless networks. The content will have a wide-ranging appeal to engineers, researchers, managers and students with interest on future of wireless. "An important publication that highlights the significance of WWRF to the wireless industry. Rarely has one publication covered the whole spectrum of future wireless technologies from human sciences to radio interface technologies, highlighting the research work done both in academic and the business worlds." Tero Ojanperä, Senior Vice President, Head of Nokia Research Center "Provides an excellent overview about the future development of mobile and wireless communication. Starting from a user centric approach and the service infrastructure, a reference model and roadmaps are being built up. This book presents useful and necessary information to all, who are involved in research and development, strategy and standardisation activities towards future systems." Anton Schaaf, CTO and Member of the executive board Siemens COM "The WWRF should be commended for taking an approach that defines technology requirements from a user perspective. This publication makes an important contribution to defining the technologies that will be most relevant to future wireless communications." Padmasree Warrior, Senior Vice President, Chief Technology Officer Motorola

ARTIFICIAL INTELLIGENT TECHNIQUES FOR WIRELESS COMMUNICATION AND NETWORKING The 20 chapters address AI principles and techniques used in wireless communication and networking and outline their benefit, function, and future role in the field. Wireless communication and networking based on AI concepts and techniques are explored in this book, specifically focusing on the current research in the field by highlighting empirical results along with theoretical concepts. The possibility of applying AI mechanisms towards security aspects in the communication domain is elaborated; also explored is the application side of integrated technologies that enhance AI-based innovations, insights, intelligent predictions, cost optimization, inventory management, identification processes, classification mechanisms, cooperative spectrum sensing techniques, ad-hoc network architecture, and protocol and simulation-based environments. Audience Researchers, industry IT engineers, and graduate students working on and implementing AI-based wireless sensor networks, 5G, IoT, deep learning, reinforcement learning, and robotics in WSN, and related technologies.

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.

The cutting edge of future wireless communications

The definitive assessment of how wireless communications will evolve over the next 20 years. Predicting the future is an essential element for almost everyone involved in the wireless industry. Manufacturers predict the future when they decide on product lines to develop or research to undertake, operators when they buy licences and deploy networks, and academics when they set PhD topics. Wireless Communications: The Future provides a solid, clear and well-argued basis on which to make these predictions. Starting with a description of the current situation and a look at how previous predictions made in 2000 have fared, the book then provides the contributions of six eminent experts from across the wireless industry. Based on their input and a critical analysis of the current situation, it derives detailed forecasts for 2011 through to 2026. This leads to implications across all of the different stakeholders in the wireless industry and views on key developments. Presents clear and unambiguous predictions, not a range of scenarios from which the user has to decide Includes chapters covering existing wireless systems which provide solid tutorial material across a wide range of wireless devices Offers a range of views of the future from high profile contributors in various areas of the industry and from around the globe, including contributions from Vodafone and Motorola Provides a comprehensive guide to current technologies, offering keen analysis of key drivers, end user needs and key economic and regulatory constraints This book, compiled by a renowned author with a track record of successful prediction, is an essential read for strategists working for wireless manufacturers, wireless operators and device manufacturers, regulators and professionals in the telecoms industry, as well as those studying the topic or with a general interest in the future of wireless communications.

The rapid growth in mobile communications has led to an increasing demand for wideband high data rate communications services. In recent years, the Distributed Antenna System (DAS) has emerged as a promising candidate beyond 3G and 4G mobile communications. Distributed Antenna Systems: Open Architecture for Future Wireless Communications is a comprehensive technical guide that covers the fundamental concepts, recent advances and open issues of the DAS. The topic is explored with various key challenges in diverse scenarios, including architecture, capacity, connectivity, scalability, medium access control, scheduling, dynamic channel assignment and cross-layer optimization. The primary focus of this book is the introduction of concepts, effective protocols, system integration, performance analysis techniques, simulations and experiments, and more importantly, future research directions in the DAS. The first part of the book introduces DAS fundamentals, including channel models and theoretical issues, examining the capacity of the DAS with different structures. Concentrating on the MAC and protocols for the DAS, the second part of the book includes information on distributed signal processing, optimal resource allocation, cooperative MAC protocols, cross layer design, and distributed organization. The third part presents case studies and applications of the DAS, including experiment, RF engineering, and applications.

The book presents a comprehensive research results in analyzing behavior and performance of the OFDM based relay systems with SCP. Dual-hop relay scenario with three communication terminals, and no direct link between the source (S) and the destination (D) has been analyzed, as it is compliant with the accepted solutions.

Relay systems have become a subject of intensive research interest over the recent years, as it is recognized that they can improve performances and extend the coverage area of wireless communication systems. Special attention has been dedicated to them since the proposal appeared for their implementation in mobile cellular systems. Numerous researches conducted after that proposal have enabled incorporation of OFDM based relay systems in both accepted standards for IMT-Advanced systems. Nowadays, researches are ongoing with the aim to define new solutions for performance improvement of the standardized OFDM relay systems for cellular networks and one of the interesting solutions is implementation of subcarrier permutation (SCP) at the relay (R) station.The book OFDM based relay systems for future wireless communications presents a comprehensive research results in analyzing behavior and performance of the OFDM based relay systems with SCP. Dual-hop relay scenario with three communication terminals, and no direct link between the source (S) and the destination (D) has been analyzed, as it is compliant with the accepted solutions for IMT-Advanced systems. The book includes performance analysis and performance comparison of OFDM based:• amplify-and-forward (AF) relay systems with fixed gain (FG),• amplify-and-forward (AF) relay systems with variable gain (VG),• decode-and-forward (DF) relay systems,each including two SCP schemes, known to maximize the system capacity and/or improve the bit error rate (BER) performances. Performance comparisons have enabled definition of optimal solutions for the future wireless communication systems in a given conditions, and for the given optimality criteria. OFDM based relay systems for future wireless communications contains recent research results in this area and is ideal for the academic staff and master/research students in area of mobile communication systems, as well as for the personnel in communication industry.

With the ubiquitous diffusion of the IoT, Cloud Computing, 5G and other evolved wireless technologies into our daily lives, the world will see the Internet of the future expand ever more quickly. Driving the progress of communications and connectivity are mobile and wireless technologies, including traditional WLANs technologies and low, ultra-power, short and long-range technologies. These technologies facilitate the communication among the growing number of connected devices, leading to the generation of huge volumes of data. Processing and analysis of such "big data" brings about many opportunities, as well as many challenges, such as those relating to efficient power consumptions, security, privacy, management, and quality of service. This book is about the technologies, opportunities and challenges that can drive and shape the networks of the future. Written by established international researchers and experts, Networks of the Future answers fundamental and pressing research challenges in the field, including architectural shifts, concepts, mitigation solutions and techniques, and key technologies in the areas of networking. The book starts with a discussion on Cognitive Radio (CR) technologies as promising solutions for improving spectrum utilization, and also highlights the advances in CR spectrum sensing techniques and resource management methods. The second part of the book presents the latest developments and research in the areas of 5G technologies and Software Defined Networks (SDN). Solutions to the most pressing challenges facing the adoption of 5G technologies are also covered, and the new paradigm known as Fog Computing is examined in the context of 5G networks. The focus next shifts to efficient solutions for future heterogeneous networks. It consists of a collection of chapters that discuss self-healing solutions, dealing with Network Virtualization, QoS in heterogeneous networks, and energy efficient techniques for Passive Optical Networks and Wireless Sensor Networks. Finally, the areas of IoT and Big Data are discussed, including the latest developments and future perspectives of Big Data and the IoT paradigms.

Taking a coherent and logical approach, this book describesthe potential use of co-ordinated multipoint systems supportedby radio over fiber. It covers an impressive breadth of topics,ranging from components, subsystem and system architecture, tonetwork management and business perspectives. The authors showthe importance of radio over fiber in eliminating or mitigatingagainst the current, perceived barriers to the use of co-ordinatedmultipoint, and the drivers for standardisation activities infuture mobile/wireless systems over the next few years. The book brings together the system concept for centralizedprocessing, including what is required for co-existence with legacywireless systems, the algorithms that can be used for improvingwireless bandwidth utilization at physical and MAC layers and theradio over fiber network and link design necessary to support thewireless sys-

tem. Other important research is alsocovered as the authors look at compensating for radio over fiberimpairments and providing simple network managementfunctions. A study of service provision and the businesscase for such a future wireless system is also fullyconsidered. This book comes at an important time for future wireless systemswith standardization of fourth generation wireless systems stillongoing. The content enables readers to make key decisions aboutfuture standardisation and their own research work. The businessanalysis also makes the book useful to those involved in decidingthe future directions of telecoms organisations. This informationwill be core to their decision-making as it provides technicalknowledge of the state-of-the-art but also system level assessmentsof what is possible in a business environment.

OQAM/FBMC for Future Wireless Communications: Principles, Technologies and Applications introduces the concepts and key technologies of OQAM/FBMC, which has been regarded as the potential physical layer technique in future wireless communication systems. It comprises 10 chapters that provide an overview of wireless communications, introduce wireless channels, single carrier and multicarrier modulations, and three types of FBMC systems, also comparing OQAM/FBMC with OFDM. Other chapters introduce the OQAM/FBMC communication system model, the FFT implementation, CP insertion, PSD analysis, prototype filter optimization, joint PAPR reduction and sidelobe suppression, overhead reduction with virtual symbols, time and frequency domain channel estimations, block-wise SFBC for MIMO OQAM/FBMC, and much more. Provides a comprehensive guide to most major OQAM/FBMC techniques Includes a detailed comparison between OFDM and OQAM/FBMC Provides readers with a complete introduction to OQAM/FBMC, from the transmitter to the receiver Gives readers an up-to-date view of future mobile communications and how QAM/FBMC supports them