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Wireless Sensor Networks and Energy Efficiency: Protocols, Routing and Management John Wiley & Sons
This book discusses the use of the spectrum sharing techniques in cognitive radio technology, in order to address the problem of spectrum scarcity for future wireless communications. The authors describe a cognitive radio medium access control (MAC) protocol, with which throughput maximization has been achieved. The discussion also includes use of this MAC protocol for imperfect sensing scenarios and its effect on the performance of cognitive radio systems. The authors also discuss how energy efficiency has been maximized in this system, by applying a simple algorithm for optimizing the transmit power of the cognitive user. The study about the channel fading in the cognitive user and licensed user and power adaption policy in this scenario under peak transmit power and interference power constraint is also present in this book.
Fundamentals and System Designs Springer
This book provides an overview of the latest research and development of new technologies for cognitive radio, mobile communications, and wireless networks. The contributors discuss the research and requirement analysis and initial standardization work towards 5G cellular systems and the capacity problems it presents. They show how cognitive radio, with the capability to flexibly adapt its parameters, has been proposed as the enabling technology for unlicensed secondary users to dynamically access the licensed spectrum owned by legacy primary users on a negotiated or an opportunistic basis. They go on to show how cognitive radio is now perceived in a much broader paradigm that will contribute to solve the resource allocation problem that 5G requirements raise. The chapters represent hand-selected expanded papers from EAI sponsored

and hosted conferences such as the 12th EAI International Conference on Mobile and Ubiquitous Systems, the 11th EAI International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness, the 10th International Conference on Cognitive Radio Oriented Wireless Networks, the 8th International Conference on Mobile Multimedia Communications, and the EAI International Conference on Software Defined Wireless Networks and Cognitive Technologies for IoT.

Fundamentals of LTE Springer

Multi-carrier modulation, in particular orthogonal frequency division multiplexing (OFDM), has been successfully applied to a wide variety of digital communications applications for several years. Although OFDM has been chosen as the physical layer standard for a diversity of important systems, the theory, algorithms, and implementation techniques remain subjects of current interest. This book is intended to be a concise summary of the present state of the art of the theory and practice of OFDM technology. This book offers a unified presentation of OFDM theory and high speed and wireless applications. In particular, ADSL, wireless LAN, and digital broadcasting technologies are explained. It is hoped that this book will prove valuable both to developers of such systems, and to researchers and graduate students involved in analysis of digital communications, and will remain a valuable summary of the technology, providing an understanding of new advances as well as the present core technology.

Energy-Efficient Pilot-Data Power Control in MU-MIMO Communication Systems Academic Press

This book describes a new design approach for energy-efficient, Domain-Specific Instruction set Processor (DSIP) architectures for the wireless baseband domain. The innovative techniques presented enable co-design of algorithms, architectures and technology, for efficient implementation of the most advanced technologies. To demonstrate the feasibility of the author ' s design approach, case studies are included for crucial functionality of advanced wireless systems with increased computational performance, flexibility and reusability. Designers using this approach will benefit from reduced development/product costs and greater scalability to future process technology nodes.

Practical Approaches for RF Impairments Reduction Pearson Education

Massive MIMO Networks is the first book on the subject to cover the spatial channel correlation and consider rigorous signal processing design essential for the complete understanding by the students, practicing engineers and researchers working on modern day communication systems.

Optimizing Massive MIMO Link ö ping University Electronic Press

The last ten years have seen a massive growth in the number of connected wireless devices. Billions of devices are connected and managed by wireless networks. At the same time, each device needs a high throughput to support applications such as voice, real-time video, movies, and games. Demands for wireless throughput and the number of wireless devices will always increase. In addition, there is a growing concern about energy consumption of wireless communication systems. Thus, future wireless systems have to satisfy three main requirements: i) having a high throughput; ii) simultaneously serving many users; and iii) having less energy consumption. Massive multiple-input multiple-output (MIMO) technology, where a base station (BS) equipped with very large number of antennas (collocated or distributed) serves many users in the same time-frequency resource, can meet the above requirements, and hence, it is a promising candidate technology for next generations of wireless systems.

With massive antenna arrays at the BS, for most propagation environments, the channels become favorable, i.e., the channel vectors between the users and the BS are (nearly) pairwisely orthogonal, and hence, linear processing is nearly optimal. A huge throughput and energy efficiency can be achieved due to the multiplexing gain and the array gain. In particular, with a simple power control scheme, Massive MIMO can offer uniformly good service for all users. In this dissertation, we focus on the performance of Massive MIMO. The dissertation consists of two main parts: fundamentals and system designs of Massive MIMO. In the first part, we focus on fundamental limits of the system performance under practical constraints such as low complexity processing, limited length of each coherence interval, intercell interference, and finite-dimensional channels. We first study the potential for power savings of the Massive MIMO uplink with maximum-ratio combining (MRC), zero-forcing, and minimum mean-square error receivers, under perfect and imperfect channels. The energy and spectral efficiency tradeoff is investigated. Secondly, we consider a physical channel model where the angular domain is divided into a finite number of distinct directions. A lower bound on the capacity is derived, and the effect of pilot contamination in this finite-dimensional channel model is analyzed. Finally, some aspects of favorable propagation in Massive MIMO under Rayleigh fading and line-of-sight (LoS) channels are investigated. We show that both Rayleigh fading and LoS environments offer favorable propagation. In the second part, based on the fundamental analysis in the first part, we propose some system designs for Massive MIMO. The acquisition of channel state information (CSI) is very importantin Massive MIMO. Typically, the channels are estimated at the BS through uplink training. Owing to the limited length of the coherence interval, the system performance is limited by pilot contamination. To reduce the pilot contamination effect, we propose an eigenvalue-decomposition-based scheme to estimate the channel directly from the received data. The proposed scheme results in better performance compared with the conventional training schemes due to the reduced pilot contamination. Another important issue of CSI acquisition in Massive MIMO is how to acquire CSI at the users. To address this issue, we propose two channel estimation schemes at the users: i) a downlink "beamforming training" scheme, and ii) a method for blind estimation of the effective downlink channel gains. In both schemes, the channel estimation overhead is independent of the number of BS antennas. We also derive the optimal pilot and data powers as well as the training duration allocation to maximize the sum spectral efficiency of the Massive MIMO uplink with MRC receivers, for a given total energy budget spent in a coherence interval. Finally, applications of Massive MIMO in relay channels are proposed and analyzed. Specifically, we consider multipair relaying systems where many sources simultaneously communicate with many destinations in the same time-frequency resource with the help of a massive MIMO relay. A massive MIMO relay is equipped with many collocated or distributed antennas. We consider different duplexing modes (full-duplex and half-duplex) and different relaying protocols (amplify-and-forward, decode-and-forward, two-way relaying, and one-way relaying) at the relay. The potential benefits of massive MIMO technology in these relaying systems are explored in terms of spectral efficiency and power efficiency.

Energy Management in Wireless Cellular and Ad-hoc Networks
Springer
The book focuses on both theory and applications in the broad areas of communication technology, computer science and information security. This two volume book contains the

Proceedings of International Conference on Advanced Computing and Intelligent Engineering. These volumes bring together academic scientists, professors, research scholars and students to share and disseminate information on knowledge and scientific research works related to computing, networking, and informatics to discuss the practical challenges encountered and the solutions adopted. The book also promotes translation of basic research into applied investigation and convert applied investigation into practice.

Digital Information and Communication Technology and Its Applications Link ö ping University Electronic Press

This book constitutes the joint refereed proceedings of the 12 International Conference on Next Generation Teletraffic and Wired/Wireless Advanced Networking, NEW2AN, and the 5th Conference on Internet of Things and Smart Spaces, ruSMART 2012, held in St. Petersburg, Russia, in August 2012. The total of 42 papers was carefully reviewed and selected for inclusion in this book. The 14 papers selected from ruSMART are organized in topical sections named: defining an internet-of-things ecosystem; future services; and smart space governing through service mashups. The 28 papers from NEW2AN deal with the following topics: wireless cellular networks; ad-hoc, mesh, and delay-tolerant networks; scalability, cognition, and self-organization; traffic and internet applications; and wireless sensor networks. They also contain 4 selected papers from the NEW2AN 2012 winter session.

Springer Science & Business Media

This book presents a synthesis of the research carried out in the Laboratory of Signal Processing and Communications (LaPSyC), CONICET, Universidad Nacional del Sur, Argentina, since 2003. It presents models and techniques widely used by the signal processing community, focusing on low-complexity methodologies that are scalable to different applications. It also highlights measures of the performance and impact of each compensation technique. The book is divided into three parts: 1) basic models 2) compensation techniques and 3) applications in advanced technologies. The first part addresses basic architectures of transceivers, their component blocks and modulation techniques. It also describes the performance to be taken into account, regardless of the distortions that need to be compensated. In the second part, several schemes of compensation and/or reduction of imperfections are explored, including linearization of power amplifiers, compensation of the characteristics of analog-to- digital converters and CFO compensation for OFDM modulation. The third and last part demonstrates the use of some of these techniques in modern wireless-communication systems, such as full-duplex transmission, massive MIMO schemes and Internet of Things applications.

Design and Implementation for Emerging Wireless Systems CRC Press

Multiple-input multiple-output (MIMO) antenna system is considered as a core technology for wireless communication. To reap the benefits of MIMO at a greater scale, massive MIMO with very large antenna arrays deployed at base station (BS) has recently become the forefront in wireless communication research. Till present, the design and analysis of large-scale MIMO systems is a fairly new subject. On the other hand, excessive power usage in MIMO networks is a crucial issue for mobile operators and the explosive growth of wireless services contributes largely to the worldwide carbon footprint. As such, significant efforts have been devoted to improve the spectral

efficiency (SE) as well as energy efficiency (EE) of MIMO communication systems over the past decade, resulting in many energy efficient techniques such as power allocation. This thesis investigates novel energy-efficient pilot-data power control strategies which can be used in both conventional MIMO and massive MIMO communication systems. The new pilot-data power control algorithms are developed based ontwo optimization frameworks: one aims to minimize the total transmit power while satisfying per-user signal-interference-plus-noise ratio (SINR) and power constraints; the other aims to maximize the total EE, which is defined as the ratio of the total SE to the transmit power, under individual user power constraints. The proposed novel pilot-data power allocation schemes also take into account the maximum-ratio combining (MRC) and zero-forcing (ZF) detectors in the uplink together with maximum-ratio transmission (MRT) and ZF precoder in the downlink. Considering that a direct use of such SINR expressions in the power control schemeswould lead to a very difficult optimization problem which is not mathematically tractable, we first investigatethe statistical SINR lower bounds for multi-cell multi-user MIMO (MU-MIMO)communication systemsunder minimum mean square error (MMSE) channel estimation. These lower bounds of the per-user average SINRs are used to replace the true SINRs to simplify the power allocation optimization problems. Such relaxation of the original average SINR yields a simplified problem and leads to a suboptimal solution. Then, based on the derived average SINR lower bounds, two novel energy efficient pilot-data power control problems are formulatedwithin the first optimization framework,aiming to minimize the total transmit power budget subject to the per-user SINR requirement and power consumption constraint in multi-cell MU-MIMO systems. For the EE-optimal power allocation problems with MRT precoder and MRC detector, it is revealed that such minimization problems can be converted to a standard geometric programming (GP) procedure which can be further converted to a convex optimization problem. For the pilot-data power control scheme with ZF precoder and ZF detector, geometric inequality is used to approximate the original non-convex optimization to GP problem. The very large number of BS station situation is also discussed by assuming infinite antennas at BS. Numerical results validate the tightness of the derived SINR lower bounds and the advantages of the proposed energy efficient power allocation schemes. Next, two pilot and data power control schemes are developed based on the second power allocation optimization framework to jointly maximize the total EE for both uplink and downlink transmissions in multi-cell MU-MIMO systems under per-user and BS power constraints. The original power control problems are simplified to equivalent convex problems based on the derived SINR lower bounds along with the Dinkelbach's method and the FrankWolfe (FW) iteration. By assuming infinite antennas at BS, the pilot-data power control in massive MIMO case is also discussed. The performance of the proposed pilot-data power allocation schemes based on the two frameworks, namely total transmit power minimization

and total EE maximization, are evaluated and compared with the SE maximization scheme. Furthermore, we investigate the pilot-data power allocation for EE communications in single-cell MU-MIMO systems with circuit power consumption in consideration. The pilot and data power allocation schemes are proposed to minimize the total weighted uplink and downlink transmit power as well as processing circuit power consumption while meeting the per-user SINR and BS power consumption constraints. In our proposed schemes, both fixed and flexible numbers of BS antennas are investigated. For the fixed number of BS antennas case, the non-convex optimization problems are converted to a general GP problem to facilitate the solution. An iterative algorithm is proposed to solve the EE-optimal power control problems in the flexible number of BS antennas casebased on the partial convexity of both the cost function and the constraints. It is shown that the convergence of the proposed iterative algorithm is guaranteed due to the fact that each iteration follows convex optimization.

Theory and Practice Springer This book investigates energy management approaches for energy efficient or energy-centric system design and architecture and presents end-to-end energy management in the recent heterogeneous-type wireless network medium. It also considers energy management in wireless sensor and mesh networks by exploiting energy efficient transmission techniques and protocols. and explores energy management in emerging applications, services and engineering to be facilitated with 5G networks such as WBANs, VANETS and Cognitive networks. A special focus of the book is on the examination of the energy management practices in emerging wireless cellular and ad hoc networks. Considering the broad scope of energy management in wireless cellular and ad hoc networks, this book is organized into six sections covering range of Energy efficient systems and architectures; Energy efficient transmission and techniques; Energy efficient applications and services.

Fundamentals of 5G Mobile Networks John Wiley & Sons MIMO Processing for 4G and Beyond: Fundamentals and Evolution offers a cutting-edge look at multiple-input multiple-output (MIMO) signal processing, namely its detection (in both time and frequency domains) and precoding. It examines its integration with OFDM, UWB, and CDMA, along with the impact of these combinations at the system level. Massive M

Scalability, Signal Processing and Power Control Link ö ping University Electronic Press This book constitutes the thoroughly refereed post-conference proceedings of the First International Joint Conference on Green Communication and Networking (GreeNets 2011), held in Colmar, France, on October 5-7, 2011. The 16 revised full papers presented were carefully selected and reviewed from numerous submissions and explain the scope and challenges of designing, building, and deploying GreeNets. In this regard, the conference aims to establish a forum to bring together research professionals from diverse fields including green mobile networks, system architectures, networking & communication protocols, applications, test-bed and prototype, traffic balance and energy-efficient cooperation transmission, system and application issues related to GreenNets.

Optimal Power Allocation for Energy Efficient MIMO Relay Systems in 5G Wireless Communication Cambridge University Press
Multi-antenna techniques are widely considered to be the most promising avenue for significantly increasing the bandwidth efficiency of wireless data transmission systems. In so called MIMO (multiple input multiple output) systems, multiple antennas are deployed both at the transmitter and the receiver. In MISO (multiple input single output) systems, the receiver has only one antenna, and the multiple transmit antennas are used for transmit diversity. The key aspects of multiple antenna transceiver techniques for evolving 3G systems and beyond are presented. MIMO and MISO (transmit diversity) techniques are explained in a common setting. In particular, the book covers linear processing transmit diversity methods with and without side information at the transmitter (feedback), including the current transmit diversity concepts in the WCDMA standards, as well as promising MIMO concepts, crucial for future high data rate systems. As an example, MIMO and MISO aspects of 3GPP HSDPA (high speed downlink packet access) will be considered. Furthermore, examples of high throughput, low complexity space-time codes will be provided, when signalling without side information (open loop concepts). The theory of linear space-time block codes will be developed, and optimal non-orthogonal high throughput codes will be constructed, both for MIMO and MISO systems. Performance may be further improved by feedback from receiver to transmitter. The corresponding closed loop modes in the current 3GPP specifications will be discussed, along with their extensions for more than two transmit antennas. In addition, feedback signalling for MIMO channels will be addressed. Optimal quantisation methods of the feedback messages will be discussed. Finally, hybrid schemes are constructed, where the amount of feedback is reduced using partly open, partly closed loop signalling. * Provides a concise and up-to-date description of perhaps the most active area of research in wireless communications * Unique in presenting recent developments in both WCDMA and MIMO * MIMO and MISO techniques are explained in a common setting * Special emphasis is placed on combining theoretical understanding with engineering applicability For Research engineers in academia and industry, and development engineers in 3G system design as well as research students.
Multi-Carrier Digital Communications Springer Nature
The Definitive Guide to LTE Technology Long-Term Evolution (LTE) is the next step in the GSM evolutionary path beyond 3G technology, and it is strongly positioned to be the dominant global standard for 4G cellular networks. LTE also represents the first generation of cellular networks to be based on a flat IP architecture and is designed to seamlessly support a variety of different services, such as broadband data, voice, and multicast video. Its design incorporates many of the key innovations of digital communication, such as MIMO (multiple input multiple output) and OFDMA (orthogonal frequency division multiple access), that mandate new skills to plan, build, and deploy an LTE network. In Fundamentals of LTE , four leading experts from academia and industry explain the technical foundations of LTE in a tutorial style—providing a comprehensive overview of the standards. Following the same approach that made their recent

Fundamentals of WiMAX successful, the authors offer a complete framework for understanding and evaluating LTE. Topics include Cellular wireless history and evolution: Technical advances, market drivers, and foundational networking and communications technologies Multicarrier modulation theory and practice: OFDM system design, peak-to-average power ratios, and SC-FDE solutions Frequency Domain Multiple Access: OFDMA downlinks, SC-FDMA uplinks, resource allocation, and LTE-specific implementation Multiple antenna techniques and tradeoffs: spatial diversity, interference cancellation, spatial multiplexing, and multiuser/networked MIMO LTE standard overview: air interface protocol, channel structure, and physical layers Downlink and uplink transport channel processing: channel encoding, modulation mapping, Hybrid ARQ, multi-antenna processing, and more Physical/MAC layer procedures and scheduling: channel-aware scheduling, closed/open-loop multi-antenna processing, and more Packet flow, radio resource, and mobility management: RLC, PDCP, RRM, and LTE radio access network mobility/handoff procedures

Energy and Spectrum Efficient Wireless Network Design IGI Global

Written by pioneers of the concept, this is the first complete guide to the physical and engineering principles of Massive MIMO. Assuming only a basic background in communications and statistical signal processing, it will guide readers through key topics in multi-cell systems such as propagation modeling, multiplexing and de-multiplexing, channel estimation, power control, and performance evaluation. The authors' unique capacity-bounding approach will enable readers to carry out effective system performance analyses and develop advanced Massive MIMO techniques and algorithms. Numerous case studies, as well as problem sets and solutions accompanying the book online, will help readers put knowledge into practice and acquire the skill set needed to design and analyze complex wireless communication systems. Whether you are a graduate student, researcher, or industry professional working in the field of wireless communications, this will be an indispensable guide for years to come.

Visible Light Communication Cambridge University Press

This two-volume set CCIS 166 and CCIS 167 constitutes the refereed proceedings of the International Conference on Digital Information and Communication Technology and its Applications, DICTAP 2011, held in Dijon, France, in June 2010. The 128 revised full papers presented in both volumes were carefully reviewed and selected from 330 submissions. The papers are organized in topical sections on Web applications; image processing; visual interfaces and user experience; network security; ad hoc network; cloud computing; Data Compression; Software Engineering; Networking and Mobiles; Distributed and Parallel processing; social networks; ontology; algorithms; multimedia; e-learning; interactive environments and emergent technologies for e-learning; signal processing; information and data management.

12th International Conference, NEW2AN 2012, and 5th Conference, ruSMART 2012, St. Petersburg, Russia, August 27-29, 2012, Proceedings Springer Nature

Provides the fundamental principles and practical tools needed to design next-generation wireless networks that are both energy- and spectrum-efficient.

Massive MIMO CRC Press

This book constitutes the refereed proceedings of the Second International Conference on Information, Communication and Computing Technology, ICICCT 2017, held in New Delhi, India, in May 2017. The 29 revised full papers and the 5 revised short papers presented in this volume were carefully reviewed and selected from 219 submissions. The papers are organized in topical sections on network systems and communication security; software engineering;

algorithm and high performance computing.

AI in Manufacturing and Green Technology Springer Science & Business Media

This book gives a comprehensive guide on the fundamental concepts, applications, algorithms, protocols, new trends and challenges, and research results in the area of Green Information and Communications Systems. It is an invaluable resource giving knowledge on the core and specialized issues in the field, making it highly suitable for both the new and experienced researcher in this area. Key Features: Core research topics of green information and communication systems are covered from a network design perspective, giving both theoretical and practical perspectives Provides a unified covering of otherwise disperse selected topics on green computing, information, communication and networking Includes a set of downloadable PowerPoint slides and glossary of terms for each chapter A ‘ whose-who ’ of international contributors Extensive bibliography for enhancing further knowledge Coverage includes: Smart grid technologies and communications Spectrum management Cognitive and autonomous radio systems Computing and communication architectures Data centres Distributed networking Cloud computing Next generation wireless communication systems 4G access networking Optical core networks Cooperation transmission Security and privacy

Core research topics of green information and communication systems are covered from a network design perspective, giving both a theoretical and practical perspective A ‘ whose-who ’ of international contributors Extensive bibliography for enhancing further knowledge