

Claude Oestges and Bruno Clerckx

MIMO WIRELESS COMMUNICATIONS

From Real-World Propagation to
Space-Time Code Design



Mimo Wireless Communications From Real World Propagation To Space Time Code Design

Serguei Primak, Valeri Kontorovich



Mimo Wireless Communications From Real World Propagation To Space Time Code Design:

Mimo Wireless Communications Claude Oestges, Bruno Clerckx, 2007 **Space-Time Processing for MIMO Communications** Alex Gershman, Nikos Sidiropoulos, 2005-08-05

Driven by the desire to boost the quality of service of wireless systems closer to that afforded by wireline systems space time processing for multiple input multiple output MIMO wireless communications research has drawn remarkable interest in recent years Exciting theoretical advances have been complemented by rapid transition of research results to industry products and services thus creating a vibrant new area Space time processing is a broad area owing in part to the underlying convergence of information theory communications and signal processing research that brought it to fruition This book presents a balanced and timely introduction to space time processing for MIMO communications including highlights of emerging trends such as spatial multiplexing and joint transceiver optimization Includes detailed coverage of wireless channel sounding modelling characterization and model validation Provides state of the art research results on space time coding including comprehensive tutorial coverage of orthogonal space time block codes Discusses important recent developments in spatial multiplexing transmit beam forming pre coding and joint transceiver design for the multi user MIMO downlink using full or partial CSI Illustrates all theory with numerous examples gleaned from cutting edge research from around the globe This valuable resource will appeal to engineers developers and consultants involved in the design and implementation of space time processing for MIMO communications Its accessible format amply illustrated with real world case studies contains relevant detailed advice for postgraduate students and researchers specializing in this field

Modulation and Coding Techniques in Wireless Communications Evgenii Krouk, Sergei Semenov, 2011-02-21

The high level of technical detail included in standards specifications can make it difficult to find the correlation between the standard specifications and the theoretical results This book aims to cover both of these elements to give accessible information and support to readers It explains the current and future trends on communication theory and shows how these developments are implemented in contemporary wireless communication standards Examining modulation coding and multiple access techniques the book is divided into two major sections to cover these functions The two stage approach first treats the basics of modulation and coding theory before highlighting how these concepts are defined and implemented in modern wireless communication systems Part 1 is devoted to the presentation of main L1 procedures and methods including modulation coding channel equalization and multiple access techniques In Part 2 the uses of these procedures and methods in the wide range of wireless communication standards including WLAN WiMax WCDMA HSPA LTE and cdma2000 are considered An essential study of the implementation of modulation and coding techniques in modern standards of wireless communication Bridges the gap between the modulation coding theory and the wireless communications standards material Divided into two parts to systematically tackle the topic the first part develops techniques which are then applied and tailored to real world systems in

the second part Covers special aspects of coding theory and how these can be effectively applied to improve the performance of wireless communications systems

Information and Communication Technology for Competitive Strategies

(ICTCS 2020) M. Shamim Kaiser, Juanying Xie, Vijay Singh Rathore, 2021-07-05 This book contains the best selected research papers presented at ICTCS 2020 Fifth International Conference on Information and Communication Technology for

Competitive Strategies The conference was held at Jaipur Rajasthan India during 11 12 December 2020 The book covers state of the art as well as emerging topics pertaining to ICT and effective strategies for its implementation for engineering and managerial applications This book contains papers mainly focused on ICT for computation algorithms and data analytics and IT security

Wireless Multi-Antenna Channels Serguei Primak, Valeri Kontorovich, 2011-10-14 This book offers a practical guide on how to use and apply channel models for system evaluation In this book the authors focus on modeling and simulation of multiple antennas channels including multiple input multiple output MIMO communication channels and the impact of such models on channel estimation and system performance Both narrowband and wideband models are addressed Furthermore the book covers topics related to modeling of MIMO channel their numerical simulation estimation and prediction as well as applications to receive diversity capacity and space time coding techniques Key Features Contains significant background material as well as novel research coverage which make the book suitable for both graduate students and researchers Addresses issues such as key hole correlated and non i i d channels in the frame of the Generalized Gaussian approach Provides a unique treatment of generalized Gaussian channels and orthogonal channel representation Reviews different interpretations of scattering environment including geometrical models Focuses on the analytical techniques which give a good insight into the design of systems on higher levels Describes a number of numerical simulators demonstrating the practical use of this material Includes an accompanying website containing additional materials and practical examples for self study This book will be of interest to researchers engineers lecturers and graduate students

Green RFID

Systems Luca Roselli, 2014-09-25 Learn how new materials and electronics technologies can make RFID systems more energy efficient and environmentally friendly Experts show you how energy scavenging passive chipless RFID RFID passive sensors networked RFID energy harvesting organic devices and wide area electronics can be used to develop green solutions for the Internet of Things

MIMO Wireless Networks Bruno Clerckx, Claude Oestges, 2013-01-23 This book is unique in presenting channels techniques and standards for the next generation of MIMO wireless networks Through a unified framework it emphasizes how propagation mechanisms impact the system performance under realistic power constraints Combining a solid mathematical analysis with a physical and intuitive approach to space time signal processing the book progressively derives innovative designs for space time coding and precoding as well as multi user and multi cell techniques taking into consideration that MIMO channels are often far from ideal Reflecting developments since the first edition was published this book has been thoroughly revised and now includes new sections and five new chapters respectively dealing

with receiver design multi user MIMO multi cell MIMO MIMO implementation in standards and MIMO system level evaluation Extended introduction to multi dimensional propagation including polarization aspects Detailed and comparative description of physical models and analytical representations of single and multi link MIMO channels covering the latest standardized models Thorough overview of space time coding techniques covering both classical and more recent schemes under information theory and error probability perspectives Intuitive illustration of how real world propagation affects the capacity and the error performance of MIMO transmission schemes Detailed information theoretic analysis of multiple access broadcast and interference channels In depth presentation of multi user diversity resource allocation and non linear MU MIMO precoding techniques with perfect and imperfect channel knowledge Extensive coverage of cooperative multi cell MIMO OFDMA networks including network resource allocation optimization coordinated scheduling beamforming and power control interference alignment joint processing massive and network MIMO Applications of MIMO and Coordinated Multi Point CoMP in LTE LTE A and WiMAX Theoretical derivations and results contrasted with practical system level evaluations highlighting the performance of single and multi cell MIMO techniques in realistic deployments **New Directions in Wireless Communications Systems** Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis)

Mathiopoulos, 2017-10-16 Beyond 2020 wireless communication systems will have to support more than 1 000 times the traffic volume of today's systems This extremely high traffic load is a major issue faced by 5G designers and researchers This challenge will be met by a combination of parallel techniques that will use more spectrum more flexibly realize higher spectral efficiency and densify cells Novel techniques and paradigms must be developed to meet these goals The book addresses diverse key point issues of next generation wireless communications systems and identifies promising solutions The book's core is concentrated to techniques and methods belonging to what is generally called radio access network

Radio Receivers for Systems of Fixed and Mobile Communications Vasiliy V. Logvinov, Sergey M. Smolskiy, 2022-05-13 The textbook acquaints the reader with the architecture of receivers of analog and digital radio systems helps to study the stages of designing a modern radio receiver and reveals the reasons and methods for its effective operation in networks for various purposes Particular attention is paid to the methods of generating and processing signals in the receivers of digital systems with multiple access which make it possible to provide data transfer rates close to the maximum possible according to Shannon As a textbook for students studying methods of optimal signal reception the book will also be useful to specialists in the field of telecommunications involved in the development of radio receivers The book shows how the development of theoretical circuitry and integrated technologies led to the active introduction of algorithmic methods for signal processing changed both the design of receivers and the methods of forming the information flow in free space MIMO beamforming The creation of a global 5G network based on heterogeneous networks puts forward new requirements for the architecture of receivers which are determined by the requirements to achieve high data rates low time

delays or use in networks with coordinated multipoint transmission and reception CoMP To consolidate the knowledge gained the book includes a complete set of materials for online classes including questions and answers a guide to solving problems for each chapter and computer modeling units of receivers in the MicroCAP environment based on preliminary calculations

The British National Bibliography Arthur James Wells, 2007 **Conference Proceedings**, 2004 MIMO Wireless Communications Ezio Biglieri, Robert Calderbank, Anthony Constantinides, Andrea Goldsmith, Arogyaswami Paulraj, H. Vincent Poor, 2007-01-08 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

Space-time Codes and MIMO Systems Mohinder Jankiraman, 2004 Annotation This resource takes professionals step by step from the basics of MIMO through various coding techniques to critical topics such as multiplexing and packet transmission Practical examples are emphasized and mathematics is kept to a minimum so readers can quickly and thoroughly understand the essentials of MIMO The book takes a systems view of MIMO technology that helps professionals analyze the benefits and drawbacks of any MIMO system BOOK JACKET Title Summary field provided by Blackwell North America Inc All Rights Reserved

Coding for MIMO Communication Systems Tolga M. Duman, Ali Ghayeb, 2008-03-11 Coding for MIMO Communication Systems is a comprehensive introduction and overview to the various emerging coding techniques developed for MIMO communication systems The basics of wireless communications and fundamental issues of MIMO channel capacity are introduced and the space time block and trellis coding techniques are covered in detail Other signaling schemes for MIMO channels are also considered including spatial multiplexing concatenated coding and iterative decoding for MIMO systems and space time coding for non coherent MIMO channels Practical issues including channel correlation channel estimation and antenna selection are also explored with problems at the end of each chapter to clarify many important topics A comprehensive book on coding for MIMO techniques covering main strategies Theories and practical issues on MIMO communications are examined in detail Easy to follow and accessible for both beginners and experienced practitioners in the field References at the end of each chapter for further reading Can be used with ease as a research book or a textbook on a graduate or advanced undergraduate level course This book is aimed at advanced undergraduate and postgraduate students

researchers and practitioners in industry as well as individuals working for government military science and technology institutions who would like to learn more about coding for MIMO communication systems *MIMO Wireless*

Communications over Generalized Fading Channels Brijesh Kumbhani, Rakshesh Singh Kshetrimayum, 2017-07-12 MIMO systems have been known to better the quality of service for wireless communication systems This book discusses emerging techniques in MIMO systems to reduce complexities and keep benefits unaffected at the same time It discusses about benefits and shortcomings of various MIMO technologies like spatial multiplexing space time coding spatial modulation transmit antenna selection and various power allocation schemes to optimize the performance Crux of the book is focus on MIMO communication over generalized fading channels as they can model the propagation of signals in a non homogeneous environment Relevant MATLAB codes are also included in the appendices Book is aimed at graduate students and researchers in electronics and wireless engineering specifically interested in electromagnetic theory antennas and propagation future wireless systems signal processing **Dong nan da xue xue bao**, 2007 **MIMO Wireless**

Networks, 2nd Edition Bruno Clerckx, Claude Oestges, 2013 This book is unique in presenting channels techniques and standards for the next generation of MIMO wireless networks Through a unified framework it emphasizes how propagation mechanisms impact the system performance under realistic power constraints Combining a solid mathematical analysis with a physical and intuitive approach to space time signal processing the book progressively derives innovative designs for space time coding and precoding as well as multi user and multi cell techniques taking into consideration that MIMO channels are often far from ideal Reflecting developments since the first edition was published this book has been thoroughly revised and now includes new sections and five new chapters respectively dealing with receiver design multi user MIMO multi cell MIMO MIMO implementation in standards and MIMO system level evaluation Extended introduction to multi dimensional propagation including polarization aspects Detailed and comparative description of physical models and analytical representations of single and multi link MIMO channels covering the latest standardized models Thorough overview of space time coding techniques covering both classical and more recent schemes under information theory and error probability perspectives Intuitive illustration of how real world propagation affects the capacity and the error performance of MIMO transmission schemes Detailed information theoretic analysis of multiple access broadcast and interference channels in depth presentation of multi user diversity resource allocation and non linear MU MIMO precoding techniques with perfect and imperfect channel knowledge Extensive coverage of cooperative multi cell MIMO OFDMA networks including network resource allocation optimization coordinated scheduling beamforming and power control interference alignment joint processing massive and network MIMO Applications of MIMO and Coordinated Multi Point CoMP in LTE LTE A and WiMAX Theoretical derivations and results contrasted with practical system level evaluations highlighting the performance of single and multi cell MIMO techniques in realistic deployments *MIMO System Technology for Wireless Communications* George

Tsoulos,2018-10-03 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 [Index to Theses with Abstracts Accepted for Higher Degrees by the Universities of Great Britain and Ireland and the Council for National Academic Awards](#) ,2008

Space-time Code Designs and Fast Decoding for MIMO and Cooperative Communication Systems Yue Shang,2009 Space time coding is an attractive technique to exploit the transmit diversity gain provided by a multiple input multiple output MIMO wireless system Regarding a space time code design some important concerns are high rates full diversity large coding gain diversity products and low decoding complexity However a tradeoff exists among these goals and constructing a good code that optimizes some or all of these goals is a very practical and interesting problem that has attracted a lot of attention in the past 10 years Furthermore other design issues may also matter and should be taken into account when one considers certain special scenarios to which the space time coding technique is applied In this dissertation we study both the code design at the transmitter side and the fast decoding algorithm at the receiver side for space time coding The first topic attempts to achieve both low decoding overhead and maximum full diversity for space time block codes STBC By deploying a linear detector at the receiver we can efficiently reduce the decoding complexity for an STBC and always obtain soft outputs that are desired when the STBC is concatenated with a channel code as in a real system In this dissertation we propose a design criterion for STBC to achieve full diversity with a zero forcing ZF or minimum mean square error MMSE receiver Two families of STBC orthogonal STBC OSTBC and Toeplitz codes which are known to have full diversity with ZF or MMSE receiver indeed meet this criterion as one may expect We also show that the symbol rates of STBC under this criterion are upper bounded by 1 Subsequently we propose a novel family of STBC that satisfy the criterion and thus achieve full diversity with ZF or MMSE receiver Our newly proposed STBC are constructed by overlapping the 2×2

Alamouti code and hence are named overlapped Alamouti codes. The new codes are close to orthogonal and have asymptotically optimal symbol rates. Simulation results show that overlapped Alamouti codes significantly outperform Toeplitz codes for any number of transmit antennas and also outperform OSTBC when the number of transmit antennas is above 4. The second topic concerns the design of space time trellis codes STTC for their applications in cooperative communication systems where transmission among different relay nodes that cooperate with each other is essentially asynchronous. A family of STTC that can achieve full cooperative diversity order regardless of the node transmission delays has been proposed and it was shown that the construction of this STTC family can be reduced to the design of binary matrices that can keep full row rank no matter how their rows are shifted. We call such matrices as shift full rank SFR matrices. We propose a systematic method to construct all the SFR matrices and in particular the shortest square SFR SSFR matrices that are attractive as the associated STTC require the fewest memories and hence the lowest decoding complexity. By relaxing the restriction imposed on SFR matrices we also propose two matrix variations q SFR and LT SFR matrices. In an extended cooperative system model with fractional symbol delays whose maximum value is specified, the STTC generated from q SFR and LT SFR matrices can still achieve asynchronous full diversity. As a result more eligible generator matrices than SFR ones become available and some better STTC in terms of coding gain may be found. Finally the third topic is to speed up the decoding algorithm for the vertical Bell Laboratories layered space time V BLAST scheme, a full rate STBC that however does not exploit any transmit diversity gain. A fast recursive algorithm for V BLAST with the optimal ordered successive interference cancellation SIC detection has been proposed and two improved algorithms for it have also been independently introduced by different authors lately. We first incorporate the existing improvements into the original fast recursive algorithm to give an algorithm that is the fastest known one for the optimal SIC detection of V BLAST. Then we propose a further improvement from which two new algorithms result. Relative to the fastest known one from the existing improvements, one new algorithm has a speedup of 1.3 times in both the number of multiplications and the number of additions and the other new algorithm requires less memory storage.

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