

---

# Rappaport Wireless Communication Chapter 1 Ppt

---

Wireless Communications  
 Content and Services for Wireless Communications  
 New Directions in Wireless Communications Systems  
 Mobile Media  
 Mobile Wireless Communications  
 Radio Propagation and Adaptive Antennas for Wireless Communication Links  
 Wireless Communication Systems  
 Protocols, Services and Applications  
 Wireless Communications & Networking  
 Handbook of Antennas in Wireless Communications  
 Wireless Communications  
 Future Directions  
 Applications, Networks, Platforms, Architectures, and Security  
 Updated, Expanded and Explained  
 Terrestrial, Atmospheric and Ionospheric  
 Systems Engineering in Wireless Communications  
 Cooperative Wireless Communications  
 Cognitive Radio Networks  
 Physical Principles of Wireless Communications, Second Edition  
 Terrestrial, Atmospheric, and Ionospheric  
 The Evolution of Untethered Communications  
 From Cooperative Cells to the Post-Cellular Relay Carpet  
 Digital Communications with Emphasis on Data Modems  
 Fundamentals of Wireless Communication  
 Ultra-Low Energy Wireless Sensor Networks in Practice  
 Principles of Communication Systems Simulation with Wireless Applications  
 Mobile Wireless Communications  
 Wireless Communication Technologies: New MultiMedia Systems  
 Wireless Communications  
 An Intuitive and Fundamental Guide  
 From Mobile to 5G  
 Readability  
 Principles and Practice  
 Advanced Techniques for Signal Reception  
 Theory, Realization and Deployment  
 Wireless Connectivity  
 Mobile Computing and Wireless Communications  
 Handbook on Advancements in Smart Antenna Technologies for Wireless Networks  
 MIMO System Technology for Wireless Communications  
 ZigBee Wireless Sensor and Control Network

*Rappaport Wireless Communication  
Chapter 1 Ppt*

Downloaded from [archive.imba.com](http://archive.imba.com) by  
guest

---

## JONATHAN ANIYA

---

**Wireless Communications** Springer Science & Business Media  
 Wireless technology is a truly revolutionary paradigm shift, enabling multimedia communications between people and devices from any location. It also underpins exciting applications such as sensor networks, smart homes, telemedicine, and automated highways. This book provides a comprehensive introduction to the underlying theory, design techniques and analytical tools of wireless communications, focusing primarily on the core principles of wireless system design. The book begins with an overview of wireless systems and standards. The characteristics of the wireless channel are then described, including their fundamental capacity limits. Various modulation, coding, and signal processing schemes are then discussed in detail, including state-of-the-art adaptive modulation, multicarrier, spread spectrum, and multiple antenna techniques. The concluding chapters deal with multiuser communications, cellular system design, and ad-hoc network design. Design

insights and tradeoffs are emphasized throughout the book. It contains many worked examples, over 200 figures, almost 300 homework exercises, over 700 references, and is an ideal textbook for students.

**Content and Services for Wireless Communications** John Wiley & Sons

This volume comprises the proceedings of the International Conference on Recent Cognizance in Wireless Communication & Image Processing. It brings together content from academicians, researchers, and industry experts in areas of Wireless Communication and Image Processing. The volume provides a snapshot of current progress in computational creativity and a glimpse of future possibilities. The proceedings include two kinds of paper submissions: (i) regular papers addressing foundation issues, describing original research on creative systems development and modeling; and (ii) position papers describing work-in-progress or research directions for computational creativity. This work will be useful to professionals and researchers working in the core areas of wireless communications and image processing.

**New Directions in Wireless Communications Systems** Logos

Verlag Berlin GmbH

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.

**Mobile Media** Springer

The proliferation of mobile media in recent years is an international phenomenon, with billions of devices sold annually. Mobile communications are now moving beyond individualized voice to mass media content--text, voice, sound, images, and even video. This will create new types of content that allow media companies and users to interact in new ways. There is a strong interest from the media and telecom industries in what manner of applications and content can be distributed in that fashion, and at what cost. To answer these questions, the book provides 18 chapters from internationally renowned authors. They identify likely types of content such as news, entertainment, peer-to-peer, and location-specific information; evaluate the economics, business models, and payment mechanisms necessary to support these media; and cover policy dimensions such as copyright, competitiveness, and access rights for content providers. This volume takes the reader through the various elements that need to be considered in the development of third generation (3G) content, and explains pitfalls and barriers. The result is a volume of interest to business professionals, academics, and policy makers. The book is international in focus and a glossary of terms is provided. There are few publications available which give an overview of this rapidly changing field.

*Mobile Wireless Communications* Pearson Education

The increasing demand for ubiquitous data service sets high expectations on future cellular networks. They should not only provide data rates that are higher by orders of magnitude than today's systems, but also have to guarantee high coverage and reliability. Thereby, sophisticated interference management is inevitable. The focus of this work is to develop cooperative transmission schemes that can be applied to cellular networks of the next generation and beyond. For this, conventional network architectures and communication protocols have to be challenged and new concepts need to be developed. Starting from cellular networks with base station cooperation, this thesis investigates how classical network architectures can evolve to future networks in which the mobile stations are no longer served by base stations in their close vicinity, but by a dynamic and flexible heterogeneity of different nodes. With the transition from classical cell-based networks to relay enabled post-cellular networks, we trade off node complexity with density. Aggressive spatial multiplexing can thereby deliver high data rates to large areas in a very efficient way, even when the backhaul capacity is limited or when in certain areas no backhaul access is available at all. The beneficial performance scaling shows that such post-cellular networks can offer a flexible and dynamic solution for mobile communication of future generations.

Radio Propagation and Adaptive Antennas for Wireless Communication Links John Wiley & Sons

This book provides comprehensive coverage of mobile data networking and mobile communications under a single cover for diverse audiences including managers, practicing engineers, and

students who need to understand this industry. In the last two decades, many books have been written on the subject of wireless communications and networking. However, mobile data networking and mobile communications were not fully addressed in a unified fashion. This book fills that gap in the literature and is written to provide essentials of wireless communications and wireless networking, including Wireless Personal Area Networks (WPAN), Wireless Local Area Networks (WLAN), and Wireless Wide Area Networks (WWAN). The first ten chapters of the book focus on the fundamentals that are required to study mobile data networking and mobile communications. Numerous solved examples have been included to show applications of theoretical concepts. In addition, unsolved problems are given at the end of each chapter for practice. (A solutions manual will be available.) After introducing fundamental concepts, the book focuses on mobile networking aspects. Four chapters are devoted on the discussion of WPAN, WLAN, WWAN, and internetworking between WLAN and WWAN. Remaining seven chapters deal with other aspects of mobile communications such as mobility management, security, cellular network planning, and 4G systems. A unique feature of this book that is missing in most of the available books on wireless communications and networking is a balance between the theoretical and practical concepts. Moreover, this book can be used to teach a one/two semester course in mobile data networking and mobile communications to ECE and CS students. \*Details the essentials of Wireless Personal Area Networks(WPAN), Wireless Local Are Networks (WLAN), and Wireless Wide Area Networks (WWAN) \*Comprehensive and up-to-date coverage including the latest in standards and 4G technology \*Suitable for classroom use in senior/first year grad level courses. Solutions manual and other instructor support available

**Wireless Communication Systems** CRC Press

Featuring contributions from major technology vendors, industry consortia, and government and private research establishments, the Industrial Communication Technology Handbook, Second Edition provides comprehensive and authoritative coverage of wire- and wireless-based specialized communication networks used in plant and factory automation, automotive applications, avionics, building automation, energy and power systems, train applications, and more. New to the Second Edition: 46 brand-new chapters and 21 substantially revised chapters Inclusion of the latest, most significant developments in specialized communication technologies and systems Addition of new application domains for specialized networks The Industrial Communication Technology Handbook, Second Edition supplies readers with a thorough understanding of the application-specific requirements for communication services and their supporting technologies. It is useful to a broad spectrum of professionals involved in the conception, design, development, standardization, and use of specialized communication networks as well as academic institutions engaged in engineering education and vocational training.

Protocols, Services and Applications Cambridge University Press  
Designed to help teach and understand communication systems using a classroom-tested, active learning approach. Discusses communication concepts and algorithms, which are explained using simulation projects, accompanied by MATLAB and Simulink Provides step-by-step code exercises and instructions to implement execution sequences Includes a companion website that has MATLAB and Simulink model samples and templates  
Wireless Communications & Networking CRC Press

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.

**Handbook of Antennas in Wireless Communications** CRC Press

Provides information on smart antenna technologies featuring contributions with in-depth descriptions of terminologies, concepts, methods, and applications related to smart antennas in various wireless systems.

**Wireless Communications** John Wiley & Sons

During 12-15 of September 1999, 10th International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'99) was held in Osaka Japan, and it was really a successful symposium that accommodated more than 600 participants from more than 30 countries and regions. PIMRC is really well organized annual symposium for wireless multimedia communication systems, in which, various up-to-date topics are discussed in the invited talk, panel discussions and tutorial sessions. One of the unique features of the PIMRC is that PIMRC is continuing to publish, from Kluwer Academic Publishers since 1997, a book that collects the hottest topics discussed in PIMRC. In PIMRC'97, Invited talks were summarized in "Wireless Communications - TDMA versus CDMA - (ISBN 0-7923- 8005-3)," and it was published just before PIMRC'97. This book was also distributed to all the PIMRC'97 participants as a part of proceedings for the conference. In PIMRC'98, extended version of the invited papers were summarized in *Wireless Multimedia Network Technologies* (ISBN 0-7923-8633- 7) and published in September 1999, which is almost the same timing for the PIMRC'99. In the case of PIMRC'99, to produce more informative book, we have selected topics that attracted many PIMRC'99 participants during the conference, and invited prospective authors not only from the invited speakers but also from tutorial speakers, panel organizers, panelists, and some other excellent PIMRC'99 participants.

Future Directions IGI Global

Cooperative devices and mechanisms are increasingly important to enhance the performance of wireless communications and networks, with their ability to decrease power consumption and packet loss rate and increase system capacity, computation, and network resilience. Considering the wide range of applications, strategies, and benefits associated with cooperative wireless communications, researchers and product developers need a succinct understanding of relevant theory, fundamentals, and techniques to navigate this challenging field. *Cooperative Wireless Communications* provides just that. Assesses Applications, Benefits, and Methods of Cooperative Strategies

This comprehensive reference handbook contains useful background to develop and implement cooperative mechanisms for infrastructure-based wireless systems and self-organizing multi-hop wireless networks (e.g., ad hoc, mesh, peer-to-peer, and sensor networks). It introduces key cooperative strategies and details recent improvements to a variety of cooperative mechanisms and frameworks applicable in diverse scenarios. Addressing fundamentals and techniques, this invaluable reference: Offers comprehensive guidance on technical, practical, and deployment aspects of cooperative strategies and the latest IEEE standard specifications Explores key challenges and solutions in 3G, B3G, 4G WiMAX, and ad hoc, mesh, and sensor networks Covers cooperative diversity, virtual MIMO, cognitive radio networks, and resource and mobility management Discusses energy efficiency, relaying strategy, routing, MAC, topology control, and security Provides Guidance to Resolve Key Challenges A distinct introduction to different cooperative mechanisms, cooperation frameworks in diverse scenarios, and recent improvements to wireless network performance, this one-stop reference consolidates the essential information and guidance that readers will need to resolve key challenges in various protocol issues from a cooperation perspective.

**Applications, Networks, Platforms, Architectures, and Security** Prentice Hall Professional

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.

*Updated, Expanded and Explained* Springer Science & Business Media

This book uses a practical approach in the application of theoretical concepts to digital communications in the design of software defined radio modems. This book discusses the design, implementation and performance verification of waveforms and algorithms appropriate for digital data modulation and demodulation in modern communication systems. Using a building-block approach, the author provides an introductory to the advanced understanding of acquisition and data detection using source and executable simulation code to validate the communication system performance with respect to theory and design specifications. The author focuses on theoretical analysis, algorithm design, firmware and software designs and subsystem and system testing. This book treats system designs with a

variety of channel characteristics from very low to optical frequencies. This book offers system analysis and subsystem implementation options for acquisition and data detection appropriate to the channel conditions and system specifications, and provides test methods for demonstrating system performance. This book also: Outlines fundamental system requirements and related analysis that must be established prior to a detailed subsystem design Includes many examples that highlight various analytical solutions and case studies that characterize various system performance measures Discusses various aspects of atmospheric propagation using the spherical 4/3 effective earth radius model Examines Ionospheric propagation and uses the Rayleigh fading channel to evaluate link performance using several robust waveform modulations Contains end-of-chapter problems, allowing the reader to further engage with the text Digital Communications with Emphasis on Data Modems is a great resource for communication-system and digital signal processing engineers and students looking for in-depth theory as well as practical implementations.

*Terrestrial, Atmospheric and Ionospheric* CRC Press

"Explains the transmission of image and video information over wireless channels. Describes MPEG-4, the latest video coding standard. Discusses error resilient combined source channel image and video coders, and multiple access spread spectrum and future generation wireless video communication systems."  
*Systems Engineering in Wireless Communications* Tata McGraw-Hill Education

Publisher Description

Cooperative Wireless Communications Pearson Education

Contents	1
1 Introductory Concepts	1
1.1 Introduction	1
1.2 Evolution of Mobile Radio Communications	1
1.3 Present Day Mobile Communication	3
1.4 Fundamental Techniques	4
1.4.1 Radio Transmission Techniques	5
1.5 How a Mobile Call is Actually Made?	7
1.5.1 Cellular Concept	7
1.5.2 Operational Channels	8
1.5.3 Making a Call	8
1.6 Future Trends	10
1.7 References	10
2 Modern Wireless Communication Systems	11
2.1 1G: First Generation Networks	11
2.2 2G: Second Generation Networks	11
2.2.1 TDMA/FDD Standards	12
2.2.2 CDMA/FDD Standard	12
2.2.3 2.5G Mobile Networks	12
2.3 3G: Third Generation Networks	13
2.3.1 3G Standards and Access Technologies	14
2.3.2 3G W-CDMA (UMTS)	14
2.3.3 3G CDMA2000	16
2.3.4 3G TD-SCDMA	18
2.4 Wireless Transmission Protocols	19
2.4.1 Wireless Local Loop (WLL) and LMDS	19
2.4.2 Bluetooth	19
2.4.3 Wireless Local Area Networks (W-LAN)	20
2.4.4 WiMax	21
2.4.5 Zigbee	21
2.4.6 Wibree	21
2.5 Conclusion: Beyond 3G Networks	22
2.6 References	22
3 The Cellular Engineering Fundamentals	23
3.1 Introduction	23
3.2 What is a Cell?	23
3.3 Frequency Reuse	24
3.4 Channel Assignment Strategies	27
3.4.1 Fixed Channel Assignment (FCA)	27
3.4.2 Dynamic	

Channel Assignment (DCA)	27
3.5 Handoff Process	28
3.5.1 Factors Influencing Handoffs	29
3.5.2 Handoffs in Different Generations	31
3.5.3 Handoff Priority	33
3.5.4 A Few Practical Problems in Handoff Scenario	33
3.6 Interference & System Capacity	34
3.6.1 Co-channel interference (CCI)	34
3.6.2 Adjacent Channel Interference (ACI)	37
3.7 Enhancing Capacity And Cell Coverage	38
3.7.1 The Key Trade-off	38
3.7.2 Cell-Splitting	40
3.7.3 Sectoring	43
3.7.4 Microcell Zone Concept	46
3.8 Trunked Radio System	47
3.9 References	53
4 Free Space Radio Wave Propagation	54
4.1 Introduction	54
4.2 Free Space Propagation Model	55
4.3 Basic Methods of Propagation	57
4.3.1 Reflection	57
4.3.2 Diffraction	58
4.3.3 Scattering	58
4.4 Two Ray Reflection Model	59
4.5 Diffraction	63
4.5.1 Knife-Edge Diffraction Geometry	64
4.5.2 Fresnel Zones: the Concept of Diffraction Loss	66
4.5.3 Knife-edge diffraction model	68
4.6 Link Budget Analysis	69
4.6.1 Log-distance Path Loss Model	69
4.6.2 Log Normal Shadowing	70
4.7 Outdoor Propagation Models	70
4.7.1 Okumura Model	70
4.7.2 Hata Model	71
4.8 Indoor Propagation Models	72
4.8.1 Partition Losses Inside a Floor (Intra-floor)	72
4.8.2 Partition Losses Between Floors (Inter-floor)	73
4.8.3 Log-distance Path Loss Model	73
4.9 Summary	73
4.10 References	73
5 Multipath Wave Propagation and Fading	75
5.1 Multipath Propagation	75
5.2 Multipath & Small-Scale Fading	75
5.2.1 Fading	76
5.2.2 Multipath Fading Effects	76
5.2.3 Factors Influencing Fading	76
5.3 Types of Small-Scale Fading	77
5.3.1 Fading Effects due to Multipath Time Delay Spread	77
5.3.2 Fading Effects due to Doppler Spread	78
5.3.3 Doppler Shift	79
5.3.4 Impulse Response Model of a Multipath Channel	80
5.3.5 Relation Between Bandwidth and Received Power	82
5.3.6 Linear Time Varying Channels (LTV)	84
5.3.7 Small-Scale Multipath Measurements	85
5.4 Multipath Channel Parameters	87
5.4.1 Time Dispersion Parameters	87
5.4.2 Frequency Dispersion Parameters	89
5.5 Statistical models for multipath propagation	90
5.5.1 NLoS Propagation: Rayleigh Fading Model	91
5.5.2 LoS Propagation: Rician Fading Model	93
5.5.3 Generalized Model: Nakagami Distribution	94
5.5.4 Second Order Statistics	95
5.6 Simulation of Rayleigh Fading Models	96
5.6.1 Clarke's Model: without Doppler Effect	96
5.6.2 Clarke and Gans' Model: with Doppler Effect	96
5.6.3 Rayleigh Simulator with Wide Range of Channel Conditions	97
5.6.4 Two-Ray Rayleigh Faded Model	97
5.6.5 Saleh and Valenzuela Indoor Statistical Model	98

5.6.6 SIRCIM/SMRCIM Indoor/Outdoor Statistical Models . . . . .	98	8.4.1 Frequency Hopped Multiple Access (FHMA) . . . . .	163
5.7 Conclusion . . . . .	99	8.4.2 Code Division Multiple Access . . . . .	163
References . . . . .	99	8.4.3 CDMA and Self-interference Problem . . . . .	164
Transmitter and Receiver Techniques	101	8.4.4 CDMA and Near-Far Problem . . . . .	165
6.1 Introduction . . . . .	101	8.4.5 Hybrid Spread Spectrum Techniques . . . . .	165
6.2 Modulation . . . . .	101	8.5 Space Division Multiple Access . . . . .	166
6.2.1 Choice of Modulation Scheme . . . . .	102	8.6 Conclusion . . . . .	166
6.2.2 Advantages of Modulation . . . . .	102	8.7 References . . . . .	167
6.2.3 Linear and Non-linear Modulation Techniques . . . . .	103		
6.2.4 Amplitude and Angle Modulation . . . . .	104	<i>Cognitive Radio Networks</i> Cambridge University Press	
6.2.5 Analog and Digital Modulation Techniques . . . . .	104	In response to a request from the Defense Advanced Research Projects Agency, the committee studied a range of issues to help identify what strategies the Department of Defense might follow to meet its need for flexible, rapidly deployable communications systems. Taking into account the military's particular requirements for security, interoperability, and other capabilities as well as the extent to which commercial technology development can be expected to support these and related needs, the book recommends systems and component research as well as organizational changes to help the DOD field state-of-the-art, cost-effective untethered communications systems. In addition to advising DARPA on where its investment in information technology for mobile wireless communications systems can have the greatest impact, the book explores the evolution of wireless technology, the often fruitful synergy between commercial and military research and development efforts, and the technical challenges still to be overcome in making the dream of "anytime, anywhere" communications a reality.	
6.3 Signal Space Representation of Digitally Modulated Signals . . . . .	104	<i>Physical Principles of Wireless Communications, Second Edition</i> Balamurali	
6.4 Complex Representation of Linear Modulated Signals and Band Pass Systems . . . . .	105	Updated and expanded, <i>Physical Principles of Wireless Communications, Second Edition</i> illustrates the relationship between scientific discoveries and their application to the invention and engineering of wireless communication systems. The second edition of this popular textbook starts with a review of the relevant physical laws, including Planck's Law of Blackbody Radiation, Maxwell's equations, and the laws of Special and General Relativity. It describes sources of electromagnetic noise, operation of antennas and antenna arrays, propagation losses, and satellite operation in sufficient detail to allow students to perform their own system designs and engineering calculations. Illustrating the operation of the physical layer of wireless communication systems—including cell phones, communication satellites, and wireless local area networks—the text covers the basic equations of electromagnetism, the principles of probability theory, and the operation of antennas. It explores the propagation of electromagnetic waves and describes the losses and interference effects that waves encounter as they propagate through cities, inside buildings, and to and from satellites orbiting the earth. Important natural phenomena are also described, including Cosmic Microwave Background Radiation, ionospheric reflection, and tropospheric refraction. New in the Second Edition: Descriptions of 3G and 4G cell phone systems Discussions on the relation between the basic laws of quantum and relativistic physics and the engineering of modern wireless communication systems A new section on Planck's Law of Blackbody Radiation Expanded discussions on general relativity and special relativity and their relevance to GPS system design An expanded chapter on antennas that includes wire loop antennas Expanded discussion of shadowing correlations and their effect on cell phone system design The text covers the physics of Geostationary Earth Orbiting satellites, Medium Earth Orbiting satellites, and Low Earth Orbiting satellites enabling students to evaluate and make first order designs of SATCOM systems. It also	
6.5 Linear Modulation Techniques . . . . .	106		
6.5.1 Amplitude Modulation (DSBSC) . . . . .	106		
6.5.2 BPSK . . . . .	107		
6.5.3 QPSK . . . . .	107		
6.5.4 Offset-QPSK . . . . .	108		
6.5.5 =4 DQPSK . . . . .	110		
6.6 Line Coding . . . . .	110		
6.7 Pulse Shaping . . . . .	111		
6.7.1 Nyquist pulse shaping . . . . .	112		
6.7.2 Raised Cosine Roll-Off Filtering . . . . .	113		
6.7.3 Realization of Pulse Shaping Filters . . . . .	113		
6.8 Nonlinear Modulation Techniques . . . . .	114		
6.8.1 Angle Modulation (FM and PM) . . . . .	114		
6.8.2 BFSK . . . . .	116		
6.9 GMSK Scheme . . . . .	118		
6.10 GMSK Generator . . . . .	119		
6.11 Two Practical Issues of Concern . . . . .	121		
6.11.1 Inter Channel Interference . . . . .	121		
6.11.2 Power Amplifier Nonlinearity . . . . .	122		
6.12 Receiver performance in multipath channels . . . . .	122		
6.12.1 Bit Error Rate and Symbol Error Rate . . . . .	123		
6.13 Example of a Multicarrier Modulation: OFDM . . . . .	125		
6.13.1 Orthogonality of Signals . . . . .	125		
6.13.2 Mathematical Description of OFDM . . . . .	127		
6.14 Conclusion . . . . .	127		
6.15 References . . . . .	128		
7 Techniques to Mitigate Fading Effects	129		
7.1 Introduction . . . . .	129		
7.2 Equalization . . . . .	130		
7.2.1 A Mathematical Framework . . . . .	131		
7.2.2 Zero Forcing Equalization . . . . .	132		
7.2.3 A Generic Adaptive Equalizer . . . . .	132		
7.2.4 Choice of Algorithms for Adaptive Equalization . . . . .	134		
7.3 Diversity . . . . .	136		
7.3.1 Different Types of Diversity . . . . .	137		
7.4 Channel Coding . . . . .	143		
7.4.1 Shannon's Channel Capacity Theorem . . . . .	143		
7.4.2 Block Codes . . . . .	144		
7.4.3 Convolutional Codes . . . . .	152		
7.4.4 Concatenated Codes . . . . .	155		
7.5 Conclusion . . . . .	156		
7.6 References . . . . .	156		
8 Multiple Access Techniques	157		
8.1 Multiple Access Techniques for Wireless Communication . . . . .	157		
8.1.1 Narrowband Systems . . . . .	158		
8.1.2 Wideband Systems . . . . .	158		
8.2 Frequency Division Multiple Access . . . . .	159		
8.2.1 FDMA/FDD in AMPS . . . . .	160		
8.2.2 FDMA/TDD in CT2 . . . . .	160		
8.2.3 FDMA and Near-Far Problem . . . . .	160		
8.3 Time Division Multiple Access . . . . .	161		
8.3.1 TDMA/FDD in GSM . . . . .	161		
8.3.2 TDMA/TDD in DECT . . . . .	162		
8.4 Spread Spectrum Multiple Access . . . . .	162		

reviews the principles of probability theory to help them accurately determine the margins that must be allowed to account for statistical variation in path loss. The included problem sets and sample solutions provide students with the understanding of contemporary wireless systems needed to participate in the development of future systems.

Terrestrial, Atmospheric, and Ionospheric Routledge

The Definitive, Comprehensive Guide to Cutting-Edge Millimeter Wave Wireless Design “This is a great book on mmWave systems that covers many aspects of the technology targeted for beginners all the way to the advanced users. The authors are some of the most credible scholars I know of who are well respected by the industry. I highly recommend studying this book in detail.” —Ali Sadri, Ph.D., Sr. Director, Intel Corporation, MCG mmWave Standards and Advanced Technologies Millimeter wave (mmWave) is today's breakthrough frontier for emerging wireless mobile cellular networks, wireless local area networks, personal area networks, and vehicular communications. In the near future, mmWave products, systems, theories, and devices will come together to deliver mobile data rates thousands of times faster than today's existing cellular and WiFi networks. In Millimeter Wave Wireless Communications, four of the field's pioneers draw on their immense experience as researchers, entrepreneurs, inventors, and consultants, empowering engineers at all levels to succeed with mmWave. They deliver exceptionally clear and

useful guidance for newcomers, as well as the first complete desk reference for design experts. The authors explain mmWave signal propagation, mmWave circuit design, antenna designs, communication theory, and current standards (including IEEE 802.15.3c, Wireless HD, and ECMA/WiMedia). They cover comprehensive mmWave wireless design issues, for 60 GHz and other mmWave bands, from channel to antenna to receiver, introducing emerging design techniques that will be invaluable for research engineers in both industry and academia. Topics include Fundamentals: communication theory, channel propagation, circuits, antennas, architectures, capabilities, and applications Digital communication: baseband signal/channel models, modulation, equalization, error control coding, multiple input multiple output (MIMO) principles, and hardware architectures Radio wave propagation characteristics: indoor and outdoor applications Antennas/antenna arrays, including on-chip and in-package antennas, fabrication, and packaging Analog circuit design: mmWave transistors, fabrication, and transceiver design approaches Baseband circuit design: multi-gigabit-per-second, high-fidelity DAC and ADC converters Physical layer: algorithmic choices, design considerations, and impairment solutions; and how to overcome clipping, quantization, and nonlinearity Higher-layer design: beam adaptation protocols, relaying, multimedia transmission, and multiband considerations 60 GHz standardization: IEEE 802.15.3c for WPAN, Wireless HD, ECMA-387, IEEE 802.11ad, Wireless Gigabit Alliance (WiGig)

Related with Rappaport Wireless Communication Chapter 1 Ppt:

- Seattle Mariners Spring Training Schedule : [click here](#)