
Low Power Wireless Optical Transmission Systems For Communications Telemetry And Control

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Mobile and Wireless Communications
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Towards a Modular, Low-Power, Low-Cost, and High-Speed Underwater Optical Wireless Communication Transmitter CRC Press

Today, wireless infrared transmission has entered our homes, offices, industry and health care, with applications in the field of remote control, telemetry, and local communication. This book is about the underlying technology. As it is an outgrowth of my Ph.D. thesis, the emphasis is on fundamental aspects rather than industrial aspects, like the standardization effort by the IrDA [7]. I guess that this is not a drawback, as, eventually, the laws of physics apply to all of us! As the applied radiation is not necessarily in the infrared, throughout the

book we usually prefer the term optical transmission. As most equipment is battery-powered, the emphasis is on power optimization of the optical transmission system. System parameters as well as environmental parameters that determine the eventual transmission quality are identified, to facilitate well-reasoned system design. Many design rules, based on calculations, measurements and simulations are presented to help the designer push the performance close to the limits set by nature and the available technology. The first chapters introduce the subject and the present the scope of the book. Then, the basic transmission link is introduced in chapter 3, and strategies to optimize its signal-to-noise ratio are discussed. Lighting flicker is identified as a possible source of interference. Then,

receiver noise and bandwidth are discussed in chapter 4, mainly based on the material presented in [66], [67], [69].

Optical Wireless Communications CRC Press

This book focuses on optical wireless communications (OWC), an emerging technology with huge potential for the provision of pervasive and reliable next-generation communications networks. It shows how the development of novel and efficient wireless technologies can contribute to a range of transmission links essential for the heterogeneous networks of the future to support various communications services and traffic patterns with ever-increasing demands for higher data-transfer rates. The book starts with a chapter reviewing the OWC field, which explains different sub-technologies

(visible-light, ultraviolet (UV) and infrared (IR) communications) and introduces the spectrum of application areas (indoor, vehicular, terrestrial, underwater, intersatellite, deep space, etc.). This provides readers with the necessary background information to understand the specialist material in the main body of the book, which is in four parts. The first of these deals with propagation modelling and channel characterization of OWC channels at different spectral bands and with different applications. The second starts by providing a unified information-theoretic treatment of OWC and then discusses advanced physical-layer methodologies (including, but not limited to: advanced coding, modulation diversity, cooperation and multi-carrier techniques) and the ultimate limitations imposed by practical constraints. On top of the physical layer come the upper-layer protocols and cross-layer designs that are the subject of the third part of the book. The last part of the book features a chapter-by-chapter assessment of selected OWC applications. Optical

Wireless Communications is a valuable reference guide for academic researchers and practitioners concerned with the future development of the world's communication networks. It succinctly but comprehensively presents the latest advances in the field.

Microstrip Antennas for Mobile Wireless Communication Systems
Springer Science & Business Media

The increasing demand for extremely high-data-rate communications has urged researchers to develop new communication systems. Currently, wireless transmission with more than one Giga-bits-per-second (Gbps) data rates is becoming essential due to increased connectivity between different portable and smart devices. To realize Gbps data rates, millimeter-wave (MMW) bands around 60 GHz is attractive due to the availability of large bandwidth of 9 GHz. Recent research work in the Gbps data rates around 60 GHz band has focused on short-range indoor applications, such as uncompressed video transfer, high-speed file transfer between

electronic devices, and communication to and from kiosk. Many of these applications are limited to 10 m or less, because of the huge free space path loss and oxygen absorption for 60 GHz band MMW signal. This book introduces new knowledge and novel circuit techniques to design low-power MMW circuits and systems. It also focuses on unlocking the potential applications of the 60 GHz band for high-speed outdoor applications. The innovative design application significantly improves and enables high-data-rate low-cost communication links between two access points seamlessly. The 60 GHz transceiver system-on-chip provides an alternative solution to upgrade existing networks without introducing any building renovation or external network laying works.

Low-Power Wireless Infrared Communications
Springer Science & Business Media
Doctoral Thesis / Dissertation from the year 2011 in the subject Engineering - Communication Technology, grade: Pass, (Middlesex University in London) (School of

Engineering and Information Sciences), course: PhD, language: English, abstract: The all-around presence of wireless communication links combined with functions that support mobility will make a roaming person-bound communication network possible in the near future. This idea of a personal network, in which a user has his own communication environment available everywhere. The overall aim of this research project was to simulate the transmission wireless and baseband RF signals via fibre for a long distance in high quality, consuming a low-power budget. Therefore, this thesis demonstrated a green radio communication network and the advantage of transmitting signals via fibre rather than via air. The contributions of this research work were described in the follows: Firstly, a comparison of the power consumption in WiMAX via air and fibre is presented. As shown in the simulation results, the power budget for the transmission of 64 QAM WiMAX IEEE 802.16-2005 via air for a distance of 5km lies at -189.67 dB,

whereas for the transmission via RoF for a distance of 140km, the power consumption ranges at 65dB. Through the deployment of a triple symmetrical compensator technique, consisting of SMF, DCF and FBG, the transmission distance of the 54 Mbps WiMAX signal can be increased to 410km without increasing the power budget of 65dB. An amendment of the triple compensator technique to SMF, DCF and CFBG allows a 120Mbps WiMAX signal transmission with a clear RF spectrum of 3.5 GHz and constellation diagram over a fibre length of 792km using a power budget of 192dB. Secondly, the thesis demonstrates a simulation setup for the deployment of more than one wireless system, namely 64 QAM WiMAX IEEE 802.16-2005 and LTE, for a data bit rate of 1Gbps via Wavelength Division Multiplexing (WDM) RoF over a transmission distance of 1800km. The RoF system includes two triple symmetrical compensator techniques - DCF, SMF, and CFBG - to obtain a large bandwidth, power budget of 393.6dB and a high signal quality for the long transmission

distance. Finally, the thesis proposed a high data bit rate and energy efficient simulation architecture, applying a passive optical component for a transmission span up to 600km. A Gigabit Optical Passive Network (GPON) based on RoF downlink 2.5 Gbps and uplink 1.25Gbps is employed to carry LTE and WiMAX, also 18 digital channels by utilising Coarse Wavelength Division Multiplexing (CWDM). The setup achieved high data speed, a low power budget of 151.2dB, and an increased service length of up to 600km. Mobile and Wireless Communications Springer Science & Business Media Free space optics is a telecommunications technique which is already being used for everyday exchange of information and has many advantages over other techniques (bandwidth, low cost, mobility of the equipment, security, etc.); within the next decade, it is likely to become an integral and essential part of data-processing architectures and telecommunications. A history of wireless optical telecommunications is given, together with a recapitulation of the

application of the principles of electromagnetism to free-space optics. Coverage is also given to the transmitters and receivers of optical beams, which are the basis of any optical communication system. These devices were responsible for the first truly significant advances in the performance of these systems. Special attention is given to the problems associated with the propagation of photons, both in the presence and absence of obstacles, since these are key issues in gaining an understanding of future telecommunication systems based on wireless optics. Finally, the authors consider standards, as well as safety and confidentiality issues.

Passive Wireless Devices Using Extremely Low to High Frequency Load Modulation John Wiley & Sons

Combines theory with real-world case studies to give a comprehensive overview of modern optical wireless technology.

Visible Light Communication

Cambridge University Press

Wireless optical communication refers to

communication based on the unguided propagation of optical waves. The past 30 years have seen significant improvements in this technique – a wireless communication solution for the current millennium – that offers an alternative to radio systems; a technique that could gain attractiveness due to recent concerns regarding the potential effects of radiofrequency waves on human health. The aim of this book is to look at the free space optics that are already used for the exchange of current information; its many benefits, such as incorporating channel properties, propagation models, link budgets, data processing including coding, modulation, standards and concerns around health and safety (IEC 60825 or FCC - Class 1 for example), etc. will become indispensable over the next decade in addressing computer architectures for short-, medium- and long-range telecommunications as we move from gigabytes to terabytes per second. Wireless Optical Communications is an excellent tool for any engineer wanting to learn about wireless optical communications or involved in the

implementation of real complete systems. Students will find a wide range of information and useful concepts such as those relating to propagation, optics and photometry, as well the necessary information on safety. Contents 1. Light. 2. History of Optical Telecommunications. 3. The Contemporary and the Everyday Life of Wireless Optical Communication. 4. Propagation Model. 5. Propagation in the Atmosphere. 6. Indoor Optic Link Budget. 7. Immunity, Safety, Energy and Legislation. 8. Optics and Optronics. 9. Data Processing. 10. Data Transmission. 11. Installation and System Engineering. 12. Conclusion.

IoT and Low-Power Wireless John Wiley & Sons

The power consumption of microprocessors is one of the most important challenges of high-performance chips and portable devices. In chapters drawn from Piguet's recently published Low-Power Electronics Design, this volume addresses the design of low-power microprocessors in deep submicron technologies. It provides a focused

reference for specialists involved in systems-on-chips, from low-power microprocessors to DSP cores, reconfigurable processors, memories, ad-hoc networks, and embedded software. *Low-Power Processors and Systems on Chips* is organized into three broad sections for convenient access. The first section examines the design of digital signal processors for embedded applications and techniques for reducing dynamic and static power at the electrical and system levels. The second part describes several aspects of low-power systems on chips, including hardware and embedded software aspects, efficient data storage, networks-on-chips, and applications such as routing strategies in wireless RF sensing and actuating devices. The final section discusses embedded software issues, including details on compilers, retargetable compilers, and coverification tools. Providing detailed examinations contributed by leading experts, *Low-Power Processors and Systems on Chips* supplies authoritative information on how to maintain high performance while

lowering power consumption in modern processors and SoCs. It is a must-read for anyone designing modern computers or embedded systems.

Wireless-Powered Backscatter Communications for Internet of Things CRC Press

This book provides and assesses the techniques required for the realization of practical wireless-powered backscatter systems for large-scale and intelligent IoT networks. It explores the deployment, reliability, and security aspects of backscatter devices for both indoor and outdoor environments. The book also sheds light on some of the recently evolving technologies such as artificial intelligence/machine learning, non-orthogonal multiple access (NOMA), and multi-tone carrier techniques and identifies their application in backscatter communications. In addition, it offers a valuable blueprint for future studies in the domains of intelligent reflective surfaces, ambient backscatter communications and massive IoT networks. *Sensors and Low Power*

Signal Processing John Wiley & Sons

The 2nd Edition of *Optical Wireless Communications: System and Channel Modelling with MATLAB®* with additional new materials, is a self-contained volume that provides a concise and comprehensive coverage of the theory and technology of optical wireless communication systems (OWC). The delivery method makes the book appropriate for students studying at undergraduate and graduate levels as well as researchers and professional engineers working in the field of OWC. The book gives a detailed description of OWC, focusing mainly on the infrared and visible bands, for indoor and outdoor applications. A major attraction of the book is the inclusion of Matlab codes and simulations results as well as experimental test-beds for free space optics and visible light communication systems. This valuable resource will aid the readers in understanding the concept, carrying out extensive analysis, simulations, implementation and evaluation of OWC links. This 2nd edition is

structured into nine compact chapters that cover the main aspects of OWC systems: History, current state of the art and challenges
 Fundamental principles
 Optical source and detector and noise sources
 Modulation, equalization, diversity techniques
 Channel models and system performance analysis
 Visible light communications
 Terrestrial free space optics communications
 Relay-based free space optics communications
 Matlab codes. A number of Matlab based simulation codes are included in this 2nd edition to assist the readers in mastering the subject and most importantly to encourage them to write their own simulation codes and enhance their knowledge.
Low-Power Processors and Systems on Chips
 Springer Science & Business Media
 The demand for wireless access to network services is growing in virtually all communications and computing applications. Once accustomed to unteathered operation, users resent being tied to a desk or a fixed location, but will endure it when

there is some substantial benefit, such as higher resolution or bandwidth. Recent technological advances, however, such as the scaling of VLSI, the development of low-power circuit design techniques and architectures, increasing battery energy capacity, and advanced displays, are rapidly improving the capabilities of wireless devices. Many of the technological advances contributing to this revolution pertain to the wireless medium itself. There are two viable media: radio and optical. In radio, spread-spectrum techniques allow different users and services to coexist in the same bandwidth, and new microwave frequencies with plentiful bandwidth become viable as the speed of the supporting low-cost electronics increases. Radio has the advantage of being available ubiquitously indoors and outdoors, with the possibility of a seamless system infrastructure that allows users to move between the two. There are unanswered (but likely to be benign) biological effects of microwave radiation at higher power densities. Optical communications is enhanced by advances in photonic devices, such as

semiconductor lasers and detectors. Optical is primarily an indoor technology - where it need not compete with sunlight - and offers advantages such as the immediate availability of a broad bandwidth without the need for regulatory approval.
Optical Wireless Communication Springer
 The book gives a detailed description of optical wireless communication (OWC), including optical laser communication, visible light communication, ultraviolet communication, underwater optical communication and future communication technologies. To achieve an integration between theory and practice, the book avoids tedious mathematical deductions and includes theoretical materials as exercises. Most of the exercises are originated from published journal articles. These exercises will aid the readers in understanding the basic concept and methods and evaluating their knowledge acquisition in the field of OWC. The book is structured into Ten chapters that covers main aspects of OWC: - Optical wireless communication

system - Coherent optical communication - Modulation, demodulation, and coding - Atmospheric channel, channel estimation, and channel equalization - White LED communication - Underwater laser communication - Ultraviolet communication - Acquisition, aiming, and tracking technology - Partially coherent optical transmission - Optical communication in the future The book is a suitable reference for undergraduate or postgraduate students majored in communication engineering, electronic information engineering or computer science, as well as the engineers and technicians in related fields.

6G Wireless Springer Science & Business Media Mobile and wireless communications applications have a clear impact on improving the humanity wellbeing. From cell phones to wireless internet to home and office devices, most of the applications are converted from wired into wireless communication. Smart and advanced wireless communication environments represent the future technology and evolutionary development

step in homes, hospitals, industrial, vehicular and transportation systems. A very appealing research area in these environments has been the wireless ad hoc, sensor and mesh networks. These networks rely on ultra low powered processing nodes that sense surrounding environment temperature, pressure, humidity, motion or chemical hazards, etc. Moreover, the radio frequency (RF) transceiver nodes of such networks require the design of transmitter and receiver equipped with high performance building blocks including antennas, power and low noise amplifiers, mixers and voltage controlled oscillators. Nowadays, the researchers are facing several challenges to design such building blocks while complying with ultra low power consumption, small area and high performance constraints. CMOS technology represents an excellent candidate to facilitate the integration of the whole transceiver on a single chip. However, several challenges have to be tackled while designing and using nanoscale CMOS technologies and require innovative idea from

researchers and circuits designers. While major researchers and applications have been focusing on RF wireless communication, optical wireless communication based system has started to draw some attention from researchers for a terrestrial system as well as for aerial and satellite terminals. This renewed interested in optical wireless communications is driven by several advantages such as no licensing requirements policy, no RF radiation hazards, and no need to dig up roads besides its large bandwidth and low power consumption. This second part of the book, **Mobile and Wireless Communications: Key Technologies and Future Applications**, covers the recent development in ad hoc and sensor networks, the implementation of state of the art of wireless transceivers building blocks and recent development on optical wireless communication systems. We hope that this book will be useful for students, researchers and practitioners in their research studies.

Wireless Communications at 60 GHz: A Single-Chip Solution on CMOS Technology Springer

Nature

The Internet of Things (IoT) technology has been the heart of several technological advances in our day to day. This has been enabled by the seamless connectivity across several types of devices such as wearables, phones, and other sensors deployed across a smart home. Data-driven decision-making is pushing the bounds of connectivity. The scale of devices is increasing, and a higher communication range is desired. However, bulky batteries and power sources deter the deployment of IoT nodes. In this thesis, I categorize IoT nodes based on the desired communication range: short range up to hundreds of meters, long range up to tens of km, and very long range up to thousands of km. In each chapter of my thesis, I study each of these categories of nodes and propose solutions to achieve a higher communication range without requiring any additional power. I also demonstrate that our novel algorithms are able to accommodate a larger number of devices transmitting concurrently. I present the design and implementation of

prototypes built using off-the-shelf (OTS) components. In Chapter Three, I present PACT, a passive battery-free tag with an active radio that communicates with the reader using a novel query-response model to reduce power consumption. Our tag achieves a communication range of 400m and allows for the co-existence of hundreds of tags. In Chapter Four, I present WiChronos, a novel data modulation algorithm that is inspired by optical communication systems. The payload modulated the time interval between two wireless symbols, the preamble and the postamble. Our tag, while coexisting with thousands of other tags, can transmit to a receiver located 4.2km away. In Chapter Five, I present SatConnect, a novel continent-scale IoT node that uses OSCAR satellites to achieve a communication range of thousands of km. Experiments to demonstrate a range of 1100km are being conducted. Understanding Smart Sensors Springer Nature This book is written for academic and professional researchers

designing communication systems for pervasive and low power applications. There is an introduction to wireless sensor networks, but the main emphasis of the book is on design techniques for low power, highly integrated transceivers. Instead of presenting a single design perspective, this book presents the design philosophies from three diverse research groups, providing three completely different strategies for achieving similar goals. By presenting diverse perspectives, this book prepares the reader for the countless design decisions they will be making in their own designs.

Low-Power Wireless Sensor Networks Artech House

Wireless sensor network (WSN) is an ad-hoc network technology comprising even thousands of autonomic and self-organizing nodes that combine environmental sensing, data processing, and wireless networking. The applications for sensor networks range from home and industrial environments to military uses. Unlike the traditional computer networks, a WSN is

application-oriented and deployed for a specific task. WSNs are data centric, which means that messages are not sent to individual nodes but to geographical locations or regions based on the data content. A WSN node is typically battery powered and characterized by extremely small size and low cost. As a result, the processing power, memory, and energy resources of an individual sensor node are limited. However, the feasibility of a WSN lies on the collaboration between the nodes. A reference WSN node comprises a Micro-Controller Unit (MCU) having few Million Instructions Per Second (MIPS) processing speed, tens of kilobytes program memory, few kilobytes data memory. In addition, the node contains a short-range radio, and a set of sensors. Supply power is typically obtained with small batteries. Assuming a target lifetime of one year using AA-size batteries, the available power budget is around 1 mW. This book covers the low-power WSNs services ranging from hardware platforms and communication protocols to network deployment, and sensor data collection and actuation. The

implications of resource constraints and expected performance in terms of throughput, reliability and latency are explained. As a case study, this book presents experiments with low-energy TUTWSN technology to illustrate the possibilities and limitations of WSN applications.

Short-Range Optical Wireless CRC Press

This thesis demonstrates an underwater optical wireless communication transmitter. The transmitter has been designed to make it easy to add on to any system, while having a minimal impact on project power and cost budgets. The hardware designed for this thesis is capable of transmitting at speeds up to 8.88 Mbps with bit error ratios on the order of 10^{-5} to 10^{-2} at a received optical power from -19.2 to -27.5 dBm. The transmitter consumes 1.75 W of power and has a bill of materials cost of \$41.95. This thesis demonstrates the transmission of a 720p, one frame-per-second video with a simple RS(255,223) encoding.

Wireless Power Transmission for Sustainable Electronics CRC Press

Now in its third edition,

Understanding Smart Sensors is the most complete, up-to-date, and authoritative summary of the latest applications and developments impacting smart sensors in a single volume. This thoroughly expanded and revised edition of an Artech bestseller contains a wealth of new material, including critical coverage of sensor fusion and energy harvesting, the latest details on wireless technology, the role and challenges involved with sensor apps and cloud sensing, greater emphasis on applications throughout the book, and dozens of figures and examples of current technologies from over 50 companies. This edition provides you with knowledge regarding a broad spectrum of possibilities for technology advancements based on current industry, university and national laboratories R & D efforts in smart sensors. Updated material also identifies the need for trusted sensing, the efforts of many organizations that impact smart sensing, and more. Utilizing the latest in smart sensor, microelectromechanical systems (MEMS) and microelectronic research and development, you get

the technical and practical information you need keep your designs and products on the cutting edge. Plus, you see how network (wired and wireless) connectivity continues to impact smart sensor development. By combining information on micromachining and microelectronics, this is the first book that links these two important aspects of smart sensor technology so you don't have to keep multiple references on hand. This comprehensive resource also includes an extensive list of smart sensor acronyms and a glossary of key terms. With an effective blend of historical information and the latest content, the third edition of *Understanding Smart Sensors* provides a unique combination of foundational and future-changing information. [Enabling Optical Wired and Wireless Technologies for 5G and Beyond Networks](#) CRC Press Agriculture 5.0: Artificial Intelligence, IoT & Machine Learning provides an interdisciplinary, integrative overview of latest development in the domain of smart farming. It shows how the traditional farming

practices are being enhanced and modified by automation and introduction of modern scalable technological solutions that cut down on risks, enhance sustainability, and deliver predictive decisions to the grower, in order to make agriculture more productive. An elaborative approach has been used to highlight the applicability and adoption of key technologies and techniques such as WSN, IoT, AI and ML in agronomic activities ranging from collection of information, analysing and drawing meaningful insights from the information which is more accurate, timely and reliable. It synthesizes interdisciplinary theory, concepts, definitions, models and findings involved in complex global sustainability problem-solving, making it an essential guide and reference. It includes real-world examples and applications making the book accessible to a broader interdisciplinary readership. This book clarifies how the birth of smart and intelligent agriculture is being nurtured and driven by the deployment of tiny sensors or AI/ML enabled UAV's or low powered Internet of Things setups

for the sensing, monitoring, collection, processing and storing of the information over the cloud platforms. This book is ideal for researchers, academics, post-graduate students and practitioners of agricultural universities, who want to embrace new agricultural technologies for Determination of site-specific crop requirements, future farming strategies related to controlling of chemical sprays, yield, price assessments with the help of AI/ML driven intelligent decision support systems and use of agri-robots for sowing and harvesting. The book will be covering and exploring the applications and some case studies of each technology, that have heavily made impact as grand successes. The main aim of the book is to give the readers immense insights into the impact and scope of WSN, IoT, AI and ML in the growth of intelligent digital farming and Agriculture revolution 5.0. The book also focuses on feasibility of precision farming and the problems faced during adoption of precision farming techniques, its potential in India and various policy measures taken all over the world. The reader can

find a description of different decision support tools like crop simulation models, their types, and application in PA.

Features: Detailed description of the latest tools and technologies available for the Agriculture 5.0.

Elaborative information for different type of hardware, platforms and machine learning techniques for use in smart farming. Elucidates various types of predictive modeling techniques available for intelligent and accurate agricultural decision making from real time collected information for site specific precision farming. Information about different type of regulations and policies made by all over the world for the motivation farmers and innovators to invest and adopt the AI and ML enabled tools and farming systems for sustainable production.

A 100Mbps Free Space Optical Infrared Link

Springer Science & Business Media

"The book provides thorough discussion on emerging topics related to 6G wireless

communication systems such as programmable wireless environment (PWE); distributed and pervasive AI for wireless communications as well as terahertz (THz) communications. 6G Wireless: The Communication Paradigm Beyond 2030 provides comprehensive coverage of the vision, requirement, use-cases, enabling technologies, and challenges for the future 6G wireless communication systems. This will include key use cases such as Immersive and eXtended reality (IXR), advanced VR/AR, intelligent humanoid robotics/devices, fully autonomous transportation, intelligent and ubiquitous healthcare, neural communication through brain interface, remote surgery, holographic/3D video communications, high precision autonomous manufacturing and haptic/tactile communications. For those use cases, the book thoroughly analyses the challenges and

requirements followed by providing indepth coverage of potential enabling technologies like terahertz communications, pervasive and distributed AI battery- less/ultra-low-power devices, programmable wireless environment, metasurface for reconfigurability, cell-free or cell-less architecture, quantum communications, 3D beamforming, energy harvesting, and wireless power transfer, optical and visible light communications, blockchain, and so on. The book also presents the significant challenges facing the research community to meet the 6G requirements as well as potential research directions to address these challenges. Written in tutorial style the primary audience of the book is postgraduate students and researchers in the broad domain of wireless communications as well as research-active academics. The book can also be useful as a reference book for BSc/MSc project/thesis works"--

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