



Optical Wireless Communications

Shlomi Arnon

Optical Wireless Communications

Optical Wireless Communications Z. Ghassemlooy,W. Popoola,S. Rajbhandari,2019-04-30 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

Optical Wireless Communications Roberto Ramirez-Iniguez,Sevia M. Idrus,Ziran Sun,2008-04-03 Over the last three decades interest in Infrared IR technology as a medium to convey information has grown considerably This is reflected by the increasing number of devices such as laptops PDAs and mobile phones that incorporate optical wireless transceivers and also by the increasing number of optical wireless links available for indoor and **Optical Wireless Communications** Murat Uysal,Carlo Capsoni,Zabih Ghassemlooy,Anthony Boucouvalas,Eszter Udvary,2016-08-25 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 **Optical Wireless Communications** Z. Ghassemlooy, W. Popoola, S.

Rajbhandari, 2012-08-08 Detailing a systems approach Optical Wireless Communications System and Channel Modelling with MATLAB is a self contained volume that concisely and comprehensively covers the theory and technology of optical wireless communications systems OWC in a way that is suitable for undergraduate and graduate level students as well as researchers and professional engineers Incorporating MATLAB throughout the authors highlight past and current research activities to illustrate optical sources transmitters detectors receivers and other devices used in optical wireless communications They also discuss both indoor and outdoor environments discussing how different factors including various channel models affect system performance and mitigation techniques In addition this book broadly covers crucial aspects of OWC systems Fundamental principles of OWC Devices and systems Modulation techniques and schemes including polarization shift keying Channel models and system performance analysis Emerging visible light communications Terrestrial free space optics communication Use of infrared in indoor OWC One entire chapter explores the emerging field of visible light communications and others describe techniques for using theoretical analysis and simulation to mitigate channel impact on system performance Additional topics include wavelet denoising artificial neural networks and spatial diversity Content also covers different challenges encountered in OWC as well as outlining possible solutions and current research trends A major attraction of the book is the presentation of MATLAB simulations and codes which enable readers to execute extensive simulations and better understand OWC in general **Optical Wireless Communications** Zabih Ghassemlooy, A. C.

Boucouvalas, 2000 **Advanced Optical and Wireless Communications Systems** Ivan B. Djordjevic, 2022-06-21 The new edition of this popular textbook keeps its structure introducing the advanced topics of i wireless communications ii free space optical FSO communications iii indoor optical wireless IR communications and iv fiber optics communications but thoroughly updates the content for new technologies and practical applications The author presents fundamental concepts such as propagation principles modulation formats channel coding diversity principles MIMO signal processing multicarrier modulation equalization adaptive modulation and coding detection principles and software defined transmission first describing them and then following up with a detailed look at each particular system The book is self contained and structured to provide straightforward guidance to readers looking to capture fundamentals and gain theoretical and practical knowledge about wireless communications free space optical communications and fiber optics communications all which can

be readily applied in studies research and practical applications The textbook is intended for an upper undergraduate or graduate level courses in fiber optics communication wireless communication and free space optical communication problems an appendix with all background material needed and homework problems In the second edition in addition to the existing chapters being updated and problems being inserted one new chapter has been added related to the physical layer security thus covering both security and reliability issues New material on 5G and 6G technologies has been added in corresponding chapters

Optical Wireless Communications Anthony C. Boucouvalas,2004-11 Optical Wireless refers to the combined use of two technologies conventional radio frequency wireless and optical fibre to telecommunications It is a pervasive technology that can be found used in products from a television remote control to IrDA Infra red Data Association products Optical Wireless products are not restricted to indoor use and have an impact on outdoor applications such as Broadband Both optical and wireless are the leading technologies for current and future broadband and flexible communications There have been many new developments in the technology which are of interest to senior undergraduate and graduate engineering students Optical Wireless Communications provides an overview of the recent developments in this field and highlights the on going research in this important area It focuses on issues of Optical Wireless Techniques as it relates to indoor and outdoor applications With contributions from the leading experts in the field this superb text outlines the newest technologies including optical LANs channel modelling transceiver design wireless multimedia bluetooth and applications Optical Wireless Communications is essential reading for all postgraduate MSc PhD level students specialising in Wireless Communications companies interested in learning about and using the technology and R D engineers active in the field

Short-Range Optical Wireless Mohsen Kavehrad,M. I. Sakib Chowdhury,Zhou Zhou,2015-10-30 This book discusses the fundamental aspects of multiple source Optical Wireless Applications including Visible Light Communications VLC Moreover the authors explore VLC performance in several conventional household layouts and investigate the impact of these layouts on VLC Multiple sources increase multipath distortion Multi input Multi Output MIMO techniques will be included as they provide either reliability improvement or bandwidth efficiency increase Based on these topics the book further explores VLC performance in real applications such as aircraft cabin wireless communications In addition the authors describe the Lambertian emitting pattern of LEDs and the diffused features in indoor environments Based on the theory they trace light pulses to establish a MIMO indoor wireless channel model on specific sources layout Next they generate test data to simulate BER distribution in a room and calculate the outage Furthermore addresses the performance improvement when MIMO techniques are applied Lastly the authors investigate VLC performance in specific applications including for aircraft on board wireless communications Finally the pitfalls of MIMO systems are discussed

Advanced Technologies in Optical Wireless Communications Cuiwei He,Chen Chen,2025-09-19 Optical wireless communication OWC is an innovative technology that combines the advantages of optical fiber and radio frequency RF communication enabling high speed

broadband wireless data transmission without the requirement for licensing the used optical frequency band As a result there is a significant increase in interest in developing OWC technologies for a range of wireless applications such as indoor visible light communications VLC underwater OWC and space communications While significant progress has been made in developing OWC related technologies over the past decade many critical challenges remain unsolved or require further advancement This Reprint of the Special Issue published by Photonics aims to address some of the ongoing challenges in OWC by presenting a collection of 16 peer reviewed articles The contributions come from research institutions and universities across nine countries including Australia Belgium China Japan Germany Greece the Netherlands Spain and Ecuador reflecting the global interest and collaborative effort to advance this field

Optical Wireless Communications for Broadband Global Internet Connectivity Arun K. Majumdar,2018-10-19

Optical Wireless Communications for Broadband Global Internet Connectivity Fundamental and Potential Applications provides a comprehensive overview for readers who require information about the fundamental science behind optical wireless communications as well as up to date advanced knowledge of the state of the art technologies available today The book is a useful resource for scientists researchers engineers and students interested in understanding optical wireless communication systems for global channels Readers will find beneficial knowledge on how related technologies of optical wireless communications can be integrated into achieving worldwide Internet connectivity Presents an in depth coverage of information on optical wireless communication in a single source Combines the fundamentals with the most recent advanced technology of achieving global Internet access and connectivity Provides derivations of the mathematical equations Includes between chapter sections where information and learning from one chapter is connected to other chapters

Optical Wireless Communication Xizheng Ke,Ke Dong,2022-07-01

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

Indoor Infrared Optical Wireless Communications Ke Wang,2019-12-23

This book aims to give an overview of recent developments in

indoor near infrared optical wireless communication technologies and systems including basic theories operating fundamentals system architectures modelling experimental demonstrations advanced techniques and most recently the research efforts towards integrations Both line of sight and diffusive signals based options will be reviewed to provide readers a complete picture about this rapidly developing area which targets the provision of high speed wireless connectivity to end users in indoor environments such as offices homes and shopping centres to satisfy the growing high speed communication requirement Provides a systematic approach for the fundamentals of indoor optical wireless communications Provides an overview of recent developments in indoor infrared optical wireless communications including theoretical fundamentals Examines system architectures modelling experimental demonstrations and the research efforts towards integrations Dr Ke Wang is an Australian Research Council ARC DECRA Fellow and a senior lecturer in the School of Engineering Royal Melbourne Institute of Technology RMIT University VIC Australia He worked with the University of Melbourne Australia and Stanford University California before joining RMIT University He has published over 110 peer reviewed papers in top journals and leading international conferences including over 20 invited papers He has been awarded several prestigious national and international awards as recognition of research contributions such as the Victoria Fellowship the AIPS Young Tall Poppy Science Award and the Marconi Society Paul Baran Young Scholar Award His major areas of interest include silicon photonics integration opto electronics integrated devices and circuits nanophotonics optical wireless technology for short range applications quasi passive reconfigurable devices and applications and optical interconnects in data centres and high performance computing **Advanced Optical Wireless Communication Systems** Shlomi Arnon, John Barry, George Karagiannidis, 2012-05-24 Combines theory with real world case studies to give a comprehensive overview of modern optical wireless technology **Modulation for Optical Wireless Communications** Harita Joshi, 2012

Advanced Optical Wireless Communication Systems Shlomi Arnon, 2012 Combines theory with real world case studies to give a comprehensive overview of modern optical wireless technology **Optical Wireless Communications** Mohammadreza Aminikashani, 2016 This dissertation focuses on optical communications having recently attracted significant attentions as a promising complementary technique for radio frequency RF in both short and long range communications These systems offer significant technical and operational advantages such as higher capacity virtually unlimited reuse unregulated spectrum and robustness to electromagnetic interference Optical wireless communication OWC can be used both indoors and outdoors Part of the dissertation contains novel results on terrestrial free space optical FSO communications FSO communication is a line of sight technique that uses lasers for high rate wireless communication over distances up to several kilometers In comparison to RF counterparts a FSO link has a very high optical bandwidth available allowing aggregate data rates on the order of Tera bits per second 1 Tera bits per second is 1000 Giga bites per second However FSO suffers limitations The major limitation of the terrestrial FSO communication systems is the atmospheric

turbulence which produces fluctuations in the irradiance of the transmitted optical beam as a result of random variations in the refractive index through the link. The existence of atmospheric induced turbulence degrades the performance of FSO links particularly with a transmission distance longer than 1 kilometer. The identification of a tractable probability density function pdf to describe atmospheric turbulence under all irradiance fluctuation regimes is crucial in order to study the reliability of a terrestrial FSO system. This dissertation addresses this daunting problem and proposes a novel statistical model that accurately describes turbulence induced fading under all irradiance conditions and unifies most of the proposed statistical models derived until now in the literature. The proposed model is important for the research community working on FSO communications because it allows them to fully capitalize on the potentials of currently used FSO systems. Furthermore utilizing this new statistical channel model closed form expressions for the diversity gain and the error rate performance of FSO links with spatial diversity are derived. In addition to addressing ways to improve outdoor FSO communication systems this dissertation addresses some major challenges in indoor visible light communication VLC. VLC is an advantageous technique that is proposed for wireless indoor communications. In VLC systems the existence of multiple paths between the transmitter and receiver causes multipath distortion particularly in links using non directional transmitters and receivers or in links relying upon non line of sight propagation. This multipath distortion can lead to intersymbol interference ISI at high bit rates. Multicarrier modulation usually implemented by orthogonal frequency division multiplexing OFDM can be used to mitigate ISI and multipath dispersion. Nevertheless the performance of VLC systems employing OFDM modulation is significantly affected by nonlinear characteristic of light emitting diode LED due to the large peak to average power ratio PAPR of OFDM signal. In other words signal amplitudes below the LED turn on voltage and above the LED saturation point are clipped. This dissertation targets these important issues and successfully addresses them by developing some techniques to reduce high PAPR of optical OFDM signal and determining the optimum operating characteristics of LEDs for combined lighting and communications applications. VLC can also provide a practical solution for indoor positioning as global positioning system GPS does not provide an accurate and rapid indoor positioning since GPS radio signals are attenuated and scattered by walls of large buildings and other objects. A practical VLC system would be likely to deploy the same configuration for both positioning and communication purposes where high speed data rates are desired. This dissertation also proposes a novel OFDM VLC system that provides a high data rate transmission and can be used for both indoor positioning and communications where the multipath reflections are taken into account. Description of an experimental demonstration is also part of the dissertation where a software defined radio SDR was employed as the primary hardware and software interface to verify some of the results of the topics discussed earlier.

Trends of the Optical Wireless Communications Juan-de-Dios Sánchez- Sánchez-López,2011 Trends of the Optical Wireless Communications 2012
International Workshop on Optical Wireless Communications IEEE Staff,2012-10-22 2015 4th International Workshop on

Optical Wireless Communications (IWOW) IEEE Staff, 2015-09-07 Wireless transmission via optical carriers opens doors of opportunity in areas as yet largely unexplored. Offering significant technical and operational advantages optical wireless communication (OWC) can be in some applications a powerful alternative to and in others complementary to existing radio frequency wireless systems. Variations of OWC can be employed in a diverse range of communication applications ranging from very short range optical interconnects within integrated circuits to satellite links. In many respects OWC research is still in its infancy and calls for extensive research to begin to harness the enormous potential of the optical spectrum. International Workshop on Optical Wireless Communication (IWOW) was launched as a dedicated forum to bring together researchers, academicians and practitioners working on various aspects of OWC spanning from optical channel modelling to algorithm, protocol development and hardware system research.

High-speed Indoor Optical Wireless

Communications Mohammad Chowdhury, 2014 Optical wireless communications (OWC) is an important research area that promises to mitigate some problems currently existing in radio frequency based systems such as shortage of radio frequency spectrum, interference and necessity of transmission at very high data rates. Optical wireless communications can be both indoors and outdoors. The focus of this dissertation is on indoor optical wireless communication channels and systems. Indoor optical wireless channels pose some challenges to properly model and analyze propagation characteristics. Since light signals reflect from wall surfaces, receivers in an OWC system usually receive many reflections of the transmitted signals. This results in inter symbol interference (ISI) that has detrimental effects to the achievable performance of the system. Hence it is necessary to understand reflection patterns and consequences of multiple bounces of light signals from reflecting surfaces by properly analyzing the channel impulse response. In this dissertation, methods of simulating indoor optical wireless channel impulse responses are discussed and an algorithm is elaborated that have been developed by combining two existing popular algorithms namely Barry's algorithm and Modified Monte Carlo method thereby carrying the best features of both. Channel parameters that affect high speed data transmission such as rms delay spread is an important topic that has been discussed in details in this dissertation. Channel impulse responses of several channel conditions are simulated and associated rms delay spreads are found thereby relating the results to the locations of the receiver and the source. Every data transfer communication system has to be duplex i.e. requires both a downlink as well as an uplink channel. Hence for establishing a high speed communication system we have proposed a design of a duplex optical wireless system in this dissertation. Some considerations related to cost efficiency at the user side have been taken into account. The system is capable of working in full duplex mode. Description of an experimental demonstration is also part of the dissertation where the demonstration was involved in establishing a bi directional link that carries 10 Gbps data stream both ways and a uni directional link that carries analog Cable Television transmission. The distance between the two ends of the system is 15 m. We have shown achievability of very low BER approximately in the range of 10-20 by using off the shelf equipment and hence proposed a direct application.

of this system in datacenters to reduce the load of oversubscribed wired links connecting the top of the rack or aggregate switches

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